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# Pelagic Ostracods of the Genera *Halocypris* and *Felia* (Subfamily Halocypridinae) from the North Pacific

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**Abstract** Morphology of *Halocypris inflata* (Dana, 1853), *H. pelagica* Claus, 1890, *Felia cornuta* (Müller, 1906) and *F. bicornis* (Müller, 1906) is examined with North Pacific materials and compared with previous records. Complete synonymy and corrected distribution were given for these species. *Halocypris angustifrontalis*, new species is described in detail. It differs from known species of this genus by its very large size and the structure of the coxal segment of the mandible. Keys to all species of both genera are presented.

**Key words**: pelagic ostracods, Halocyprididae, Halocypridinae, *Halocypris*, *Felia*, North Pacific

## Introduction

Pelagic ostracods of the genera *Halocypris* (Dana, 1853) and *Felia* (Poulsen, 1969) inhabit only the tropical and subtropical zones of the World Ocean. Therefore, their finding in other climatic zones clearly suggests the advection of warm waters, e.g., the finding of ostracods of the genus *Halocypris* in the North Atlantic at 60° N (Vavra, 1906), in the Southern Ocean at 49° S in the its Pacific sector (Deevey, 1978a) and at 54° S in the its Indian sector (Deevey, 1982a), etc. Hence, these species can be useful as bioindicators of water dynamics in the subarctic and subantarctic frontal zones as well as adjacent temperate cold-water areas.

Ostracods of the genus *Halocypria* predominantly found in the surface layers, although they frequently occur at greater depth, down to 2000-3000 m (Poulsen, 1969a; Deevey, 1978a; 1982a, etc.) and even to 4000 m (Chen and Lin, 1994b).

The identification of *Felia* species presents no problems and they are readily distinguishable by shell form. Members of *Halocypris* are morphologically similar, and up to now is not agreement concerning the number of species.

Despite the fact that *Halocypris pelagica* was described more than a century ago (Claus, 1890, 1891), merely a few specialists (Brady and Norman, 1896; Brady, 1897; Cleve, 1905; Juday, 1906; Vavra, 1906) recognized its validity at the end of the past and the beginning of the current century. In their classical monographs, Müller (1906a) and Skogsberg (1920) proved that *H. pelagica* is a junior synonym of *H. inflata*, and all the subsequent zoologists accepted their point of view. Angel (1982) performed the comparative morphological studies of this genus and confirmed the validity of *H. pelagica*. However, other authors continued to merge these species into one - *H. inflata*. Apparently, the main reason for this treatment appears to be their polymorphism. Nearly all main characters (relative size of the shell, shape of the frontal organ, structure of endopodite of second antenna and the copulatory appendage, etc.) exhibit high variability. Angel (1982) separated these species on the basis of the relative height and thickness of the shell as well as the size of setae "c" and "d" on endopodite of second antenna (in male). However, our studies (unpublished data) suggested that these characters of the specimens from various regions of the Atlantic, Indian and Pacific Oceans showed a very wide range of variability; they often overlap and therefore cannot serve for the differentiation between these species. The intraspecific morphological variation of ostracods of the genus *Halocypris* within their ranges will be detailed in subsequent works. The present paper describes the morphology of the

above-noted *Halocypris* species and also *Felia cornuta* and *F. bicornis* from the North Pacific, and compared with the data from previous literature.

In addition to the above-mentioned species of the genus *Halocypris*, a new species found in collections from the North Pacific is described as *Halocypris angustifrontalis*, new species.

## Systematics

### Order HALOCYPRIDA Dana, 1853
### Suborder HALOCYPRIDINA Dana, 1853
### Superfamily HALOCYPRIDOIDEA Dana, 1853
### Family HALOCYPRIDIDAE Dana, 1853
### Subfamily HALOCYPRIDINAE Claus, 1891
### Genus *Halocypris* Dana, 1853

This genus includes only *H. inflata* (Dana, 1849), *H. pelagica* Claus, 1890 and *H. angustifrontalis*, new species. All these species were found in our samples collected from the North Pacific.

Key to Species of Genus *Halocypris*

1. Length of male is over 1.7 mm and female is over 1.8 mm; in female medioventral surface of valves bears row of glands; masticatory surface on coxale of mandible is covered with sensory filaments ..... *H. angustifrontalis*, new species
   Length of male is less 1.6 mm and female is equal or less 1.8 mm; in female medioventral surface of valves is without noticeable glands; masticatory surface on coxale of mandible is covered with spines ..... 2.
2. Shell is small (length of male is 1.00-1.34 mm and female is 1.00-1.52 mm); capitulum of frontal organ is broad (in male mean height is 30% of its length and in female 26%), in female 3 setae are placed on the ventral margin of 1st segment of mandible; copulatory appendage is broad distally ..... *H. pelagica* Claus, 1890
   Shell is large (length of male is 1.30-1.60 mm and female is 1.48-1.85 mm); capitulum of frontal organ is narrow (in male mean height is 24% of its length and in female 21%), in female 2 setae are placed on the ventral margin of 1st segment of mandible; copulatory appendage is narrow distally ..... *H. inflata* Dana, 1849

### *Halocypris angustifrontalis*, new species

(Figs. 1-5)

? *Halocypris brevirostris*: Poulsen, 1969a: 65 (part) (stations 4781 and 4788, males 1.6-1.9 mm and females 1.8-2.2 mm), 66 (part), Fig. 25 (for "SE Pacific"), table 8 (for females longer 1.7-1.8 mm from: "Pacific" of 140°-33° N, 14°-13° S, 33°-42° S), table 9 (for males longer 1.6 mm from: "Pacific" - 33°-42° S, "E Pacific" - 12°-22° S); Hanai et al., 1977: 81-82 (part); Hanai et al., 1980: 53-55 (part).

Material examined

Holotype. N1125 - adult male, length 1.82 mm, appendages mounted on slide and valves in alcohol. In collection of the Museum of Institute of Marine Biology, Vladivostok, Russia (together with paratypes).

Type - Locality: R/V SRTM 8-459, station 52, 38° 42'N, 129° 42'W, depth 0-100 m, 22 September 1971.

Paratypes. R/V SRTM 8-459: N 1127 - adult male (1.75 mm), N1129 - adult male (1.63 mm), N1126 - adult female (1.80 mm) and N1128 - adult female (1.85 mm) from same sample as holotype,

collected by Plankton Juday's Net (S=0.1 $m^3$), appendages on slides and valves in alcohol.

Etymology

The specific name "angustifrontalis", from the Latin "angusta" [=narrow] and "frontalia" [=frontal], refers to size of of capitulum of frontal organ.

Additional material. R/V SRTM 8-459, 1971 - female (2.00 mm) and male (1.85 mm), station 46, 38° 15N, 125° 46W layer 0-100 m, September 21; female (1.95 mm), station 48, 37° 55'N, 127° 21'W, layer 0-100 m, September 21; 5 males (1.70-1.82 mm), station 50, 37° 34'N, 128° 58'W, layer 0-100 m, September 22; R/V "Pelamida" 1974 - female (2.12 mm), station 69, sample 50, 33° 30'N, 149° 00'E, layer 25-50 m, June 1; female (2.05 mm), station 69, sample 50, 33° 30'N, 149° 00'E, layer 0-25 m, June 2; female (2.20 mm), same station, sample 51, layer 25-50 m; R/V "Ogon" 1975 - male N1137 (1.82 mm), male N1138 (1.77 mm), male N1139 (1.75 mm), female N1140 (deformed), female N1141 (2.05 mm) and female N1142 (2.07 mm), statin 25, 40° 10'N, 130° 20'W, layer 0-100 m, September 16; R/V "Seskar" - male N1135 (1.85 mm), station 8, sample 8, 35° 30'N, 147° 00'E, laeyr 0-100 m, June 13; female N1136 (2.02 mm), station 29, sample 29, 32° 01'N, 143° 01'E, layer 0-100 m, Jule 28; 2 females (1.80-1.82 mm), station 33, sample 84, 33° 29'N, 141° 28'E, layer 0-100 m, July 19; 2 males (1.90 and 1.90 mm), station 66, sample 46, 33° 30'N, 149° 02'E, layer 0-100 m, July 20; female (1.81 mm), station 69a, sample 50, 33° 14'N, 149° 28'E, layer 0-100 m, July 21; R/V "Pelamida" 1976 - male N1143 (1.73 mm), station 11, sample 12, 33° 00'N, 149° 00'E, layer 300-400 m, April 26; R/V "Tikhooceansky" 1979 - 3 males (1.65-1.80 mm), 37° 10'N, 127° 40'W, layer 0-100 m, July 14; male (1.70 mm) and female (2.00 mm), 37° 10'N, 124° 37'W, layer 25-50 m, August 15.

Description of adult male

Shell (Fig. 1, A-D ). The length of the carapace range from 1.63-1.85 mm. Valves are somewhat prolonged, and with equal height at the anterior and posterior parts. Height at the anterior and posterior parts of the valves is equal and 66-71% (67% - holotype) the length of their. Dorsal margin is straight, and anterior, ventral and posterior margins are slightly rounded. Rostrum is rudimentary, and rostral incisure is barely noticeable. The asymmetrical gland on the right valve is at the posterior ventral corner and on the left valve opens on a level with the posterior end of the carapace hinge. There is a faint concentric sculpturing.

Frontal organ (Fig. 1, E ). It is narrow, bare, long and extended considerably beyond the down curving distal segments of the 1st antenna. The capitulum is slightly concave medially and down turned distally, and 3 times as long as the stalk. The height of the capitulum is 21-23% (mean 22%) the length of it.

First antenna (Fig. 1, E ). The limb is 5-jointed. The dorsal seta on the 2nd segment is inserted vertically and curves anteriorly. It is covered with some short hairs and approximately twice as long as the height of this segment. The setae "a"-"d" are subequal, bare and slightly flatten into a blade distally. The seta "e" is armed with some small hairs, unflattened and 1.5 the length of the setae "a"-"d" and 3 times as long as the limb (on the dorsal side).

Second antenna (Fig. 1, F-K ). The exopodite is slim and approximately 80% the length of the protopodite. The total length of the 2nd-9th segments of the exopodite is about 40% of the 1st segment in length. The length of the setae "a"-"d" on the endopodite is very variable (in others specimens and even in one specimen): the seta "c" is longer (holotype), equal or shorter of the seta "a", the seta "d" is longer of the seta "b" (rarely "b" is missing). The seta "e" borne at the 2nd segment is tiny or absent. Shape, size and curve of the cluspers are variable. The clasper on the right limb curves through 90° at its base and again just over half way along its length. Terminaly it is slightly swollen, or unswollen (holotype), with (holotype)(or without) tiny point and there is subterminal ridging. On the left endopodite the clasper is similar, but weaker and less curved at its base. The largest seta "g" flattens into a blade distally, and is 1.5 the length of the exopodite and 3 times as long as the setae "h"-

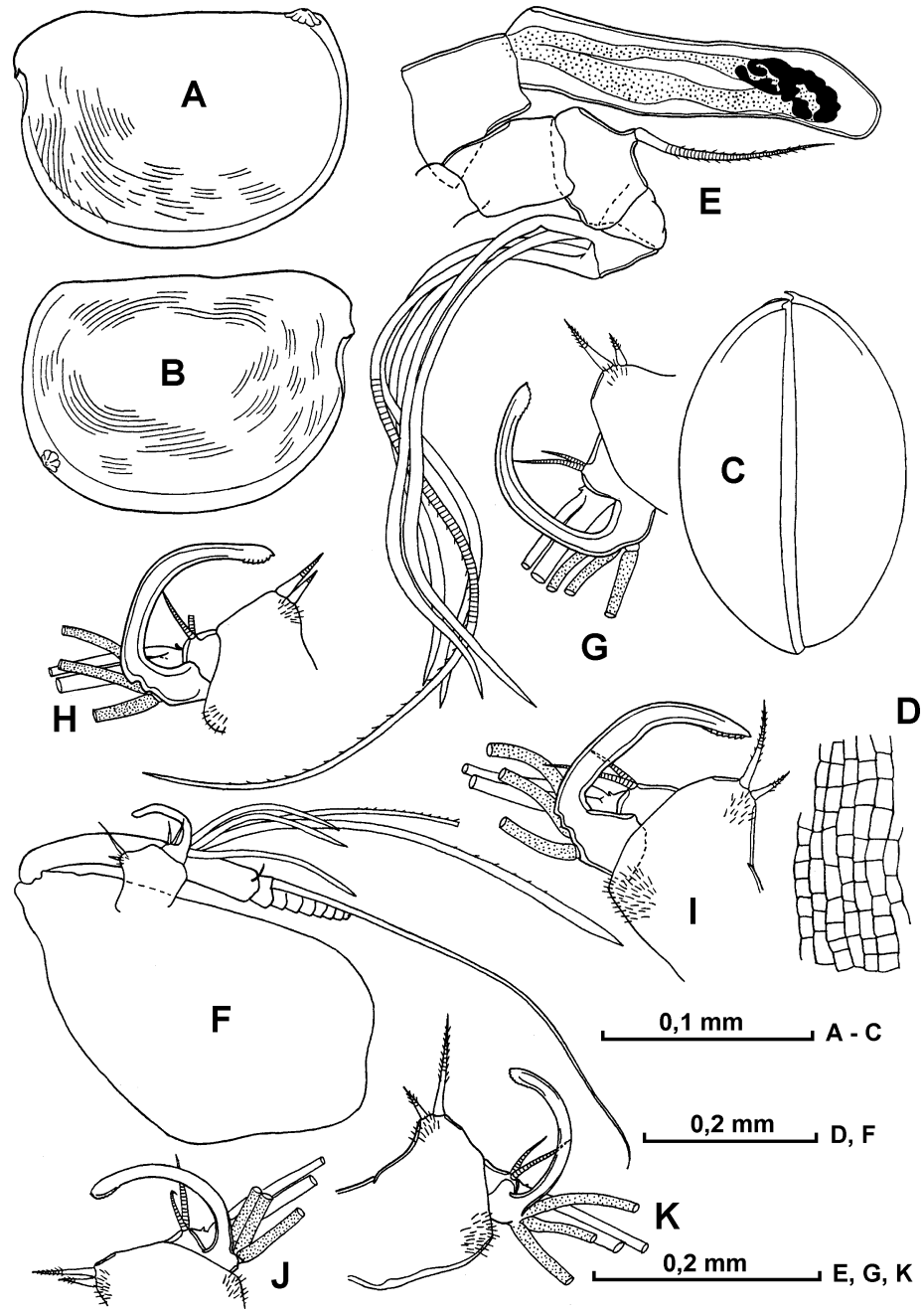


**Fig. 1.** *Halocypris angustifrontalis* n. sp. (male: A-D and H - N1129; I and J - N1125; F, G and K- N1127). A and B - left and right valves of shell in lateral view, C -shell in ventral view, D - sculpturing on shoulder-vault of shell, E - frontal organ and 1st antenna, F - 2nd antenna, G-I - right endopodite of 2nd antenna, J and K - left endopodite of 2nd antenna.

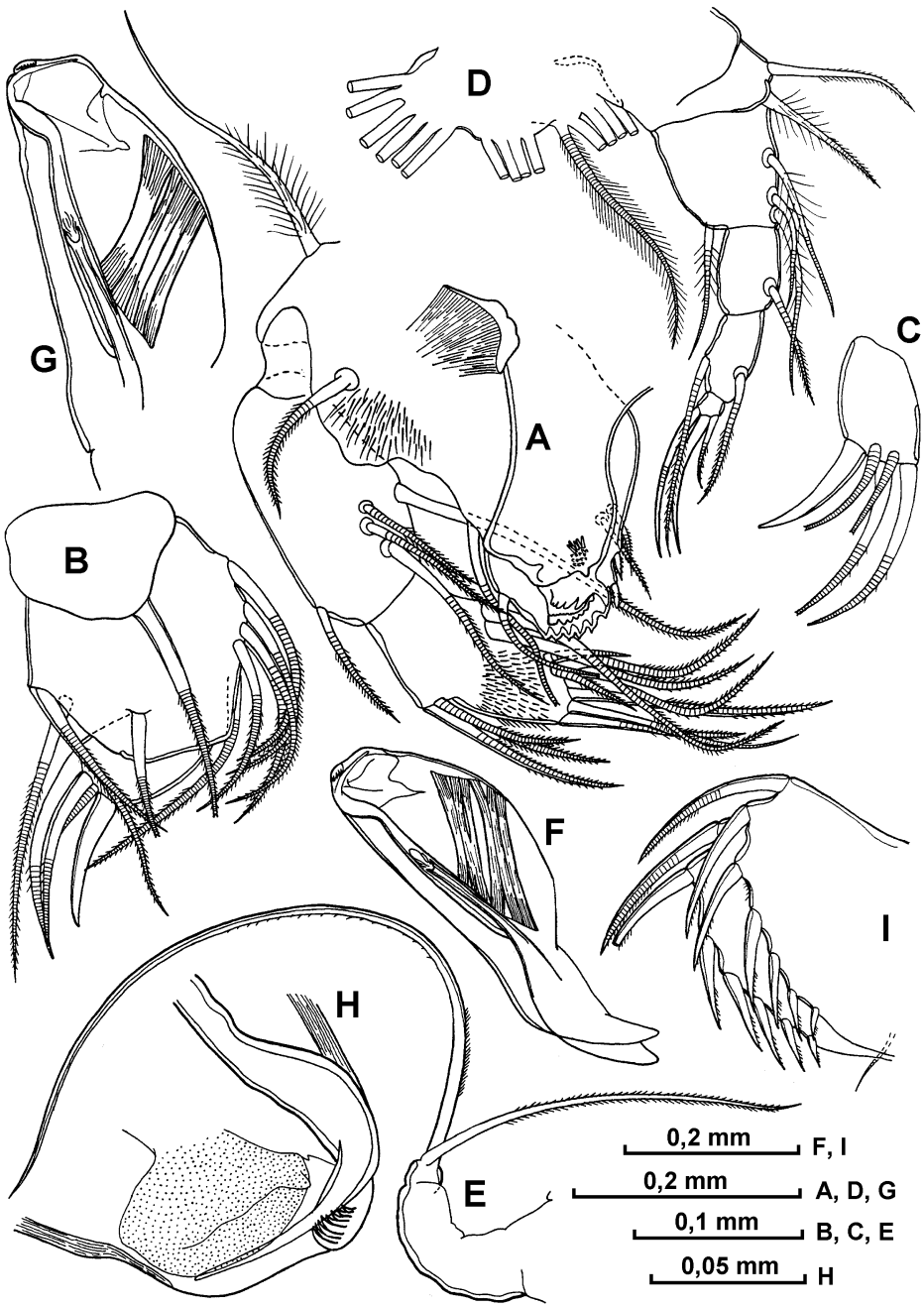


**Fig. 2.** *Halocypris angustifrontalis* n. sp. (male: A-D, F, H and I - N1125; E - N1129; G - N1127). A - mandible, B - maxilla, C - terminal segment on endopodite of maxilla, D - 6th limb, E - 7th limb, F and G - copulatory appendage , H - distal part of copulatory appendage, I - caudal furca.

"j". The seta "f" is unflattened and with some short hairs distally. Surface of the 1st segment is bare or covered with short hairs at the base the seta "b" and near of the its distoventral corner.

Mandible (Figs. 2, A and 5, D, F). The epipodite is developed and without bristle. The exopodite is represented by long stout and plumose seta. The 1st segment of the endopodite bears one short slim dorsal seta, 2 short slim and one long stout lateral and one long stout ventral setae. Last seta is 75-80% the length of the endopodite (on dorsal side). On the 2nd segment are placed one long stout and 2 shorter slight dorsal setae, and 2 long stout ventral setae. The 3rd segment is covered with small hairs and armed with 7 terminal setae, of which the 1st dorsal seta and central (main) seta are claw-like, and others are usual. Two ventrolateral setae of this segment bear usual short hairs on the each side. Basale has one stout and one slim anteroventral setae, 2 slim lateral and one stout anterodorsal setae, and anterior dense long hairs near the articulation. Basal endite carries tooth edge with 6 stout terminal and one additional small lateral triangular teeth, and 2 short posterior tube teeth, which are slightly apart. Coxale is armed with ventral tooth edge, and also distal and proximal tooth rows. On the masticatory surface are inserted about 20-30 (about 30 - holotype) sensory filaments (with rounded or pointed tip) and triangular tooth.

Maxilla (Fig. 2, B and C). The basal seta extends noticeable beyond the distal margin of the 1st endopodit segment. The length of this segment is subequal to its height. On the 1st segment are plased 6 anterior, one lateral and 3 posterior setae, and there are no spinules terminally. The 2nd segment is broad and armed with claw and 2 stout setae terminally and with subterminal pair of weaker setae inserted near the base of the central terminal claw.

Fifth limb. The 1st endite of the protopodite has one short seta, and 2nd endite with one long, one short and one minute setae. On the endopodite are placed 3 claw-like and 5 usual setae. The 1st segment of the exopodite carries one dorsal, 4 lateral and 3 ventral setae (total 8). The dorsal seta of this segment extends slightly beyond the distal margin of the limb. The 2nd segment bears one dorsal and 2 ventral setae, and 3rd with 2 (dorsal and central) claw-like and one (ventral) usual setae. This limb is without plumose setae.

Sixth limb (Fig. 2, D). The epipodial appendage has 3 groups of 5+4+6 plumose long setae. The endopodite is armed with 2 long setae, of which one is plumose. The 1st segment of the exopodite carries 3 ventral plumose setae and one dorsal plumose seta. Last seta does not reache considerably to the terminal margin of this limb. The 2nd segment bears one ventral seta, the 3rd segment has one dorsal and one ventral setae and is covered with small hairs. On the 4th segment are inserted one short and slim seta (ventrally) and 2 long and stout setae, of which central is claw-like. The dorsal seta does not reache considerably to the distal margin of the limb.

Seventh limb (Fig. 2, E ). It is narrow and long. The largest seta is approximately twice and four times as long as the short seta and the limb, respectively.

Copulatory appendage (Fig. 2, F, G). This appendage is relatively narrow, tapering towards the tip and with greatest height at the medial part. There are 4-6 (6 - holotype) oblique muscle bands, and the tip of the organ has some subterminal spinules.

Caudal furca (Fig. 2, H and I). The furca carries 7 pairs claws and an unpaired dorsal bristle. Inner surface is covered with small hairs.

Description of adult female

Shell (Fig. 3, A-C). The length of the carapace rage from 1.80-2.12 mm. The valves are rounded. The greatest height of the shell is at the posterior part and 74-78% of its length. The dorsal margin is slightly wavy, and anterior, ventral and posterior margins are rounded. The row glands are placed at the ventromedial part of the valves. Rostrum, rostral incisure, asymmetrical glands and sculpturing are very similar to those of the male.

Frontal organ (Fig. 3, D). The height of the capitulum is 19-22% (mean 21%). The rest features are same as in male.

First antenna (Fig. 3, D). Most of the characteristic features of this limb are very similar to those

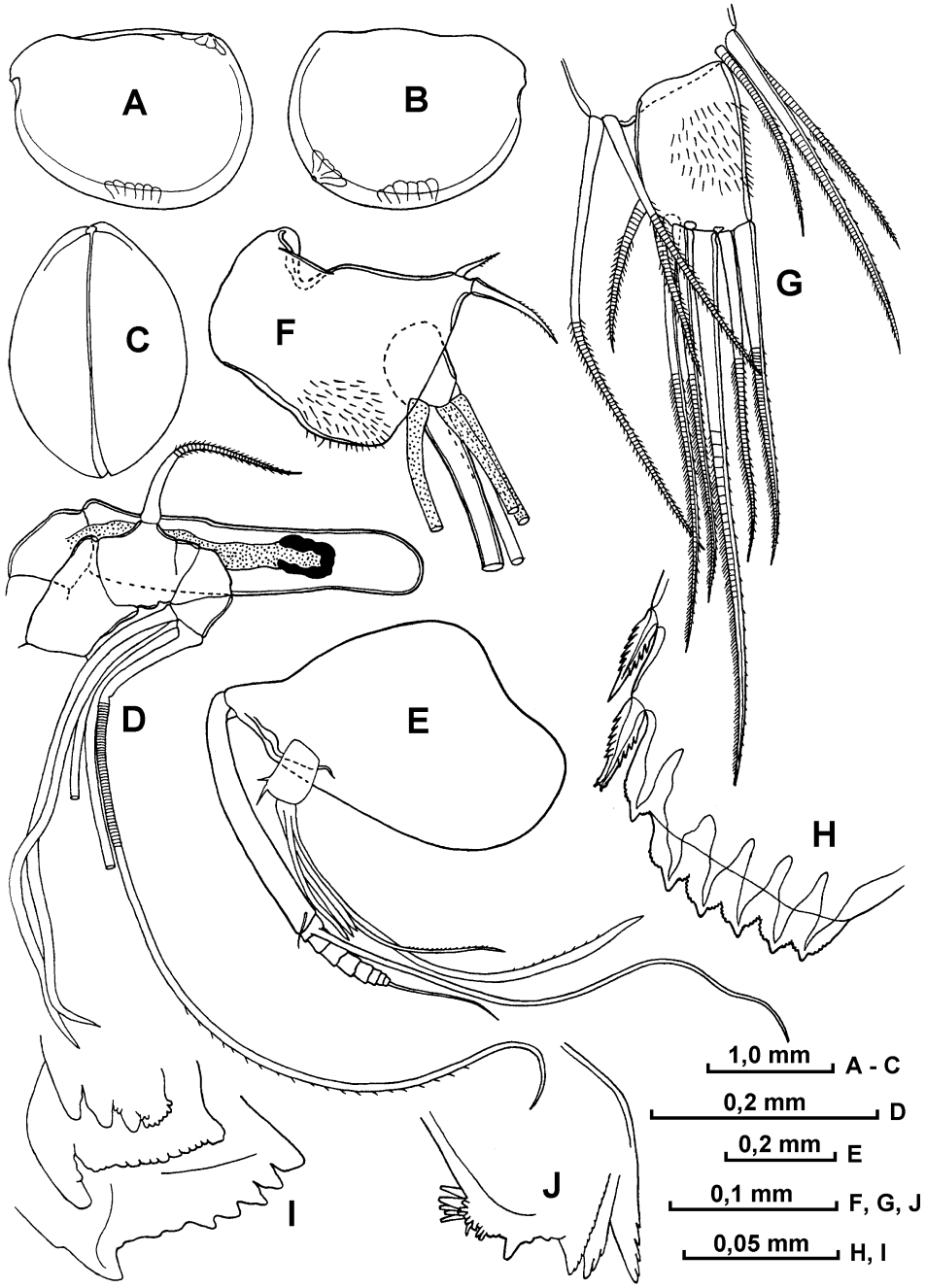


**Fig. 3.** *Halocypris angustifrontalis* n. sp. (female: A-C - R/V SRTM 8-459, St. 48; D, G-J - N1126; E and F - N1128). A and B - left and right valves of shell in lateral view, C - shell in ventral view, D - frontal organ and 1st antenna, E - 2nd antenna, F - endopodite of 2nd antenna, G - distal part of endopodite of mandible, H - basal endite of mandible, I and J - coxal endite of mandible.

of the male. Only sensory setae "a"-"d" are shorter and about 1/2 the length of the seta "e".

Second antenna (Fig. 3, E and F). The exopodite is slim and subequal to the protopodite. The total length of the 2nd-9th segments of the exopodite is approximately 40% of the 1st segment in length.The length of the setae "a" and "b" on the 1st segment of the endopodite is very variable. As a rule seta "b" is twice as long as the seta "a". The largest "g" flattens into a blade distally, and is 1/3 of the exopodite in length and three times as long as the setae "h"-"j". The seta "f" is unflattened and armed few small hairs distally.

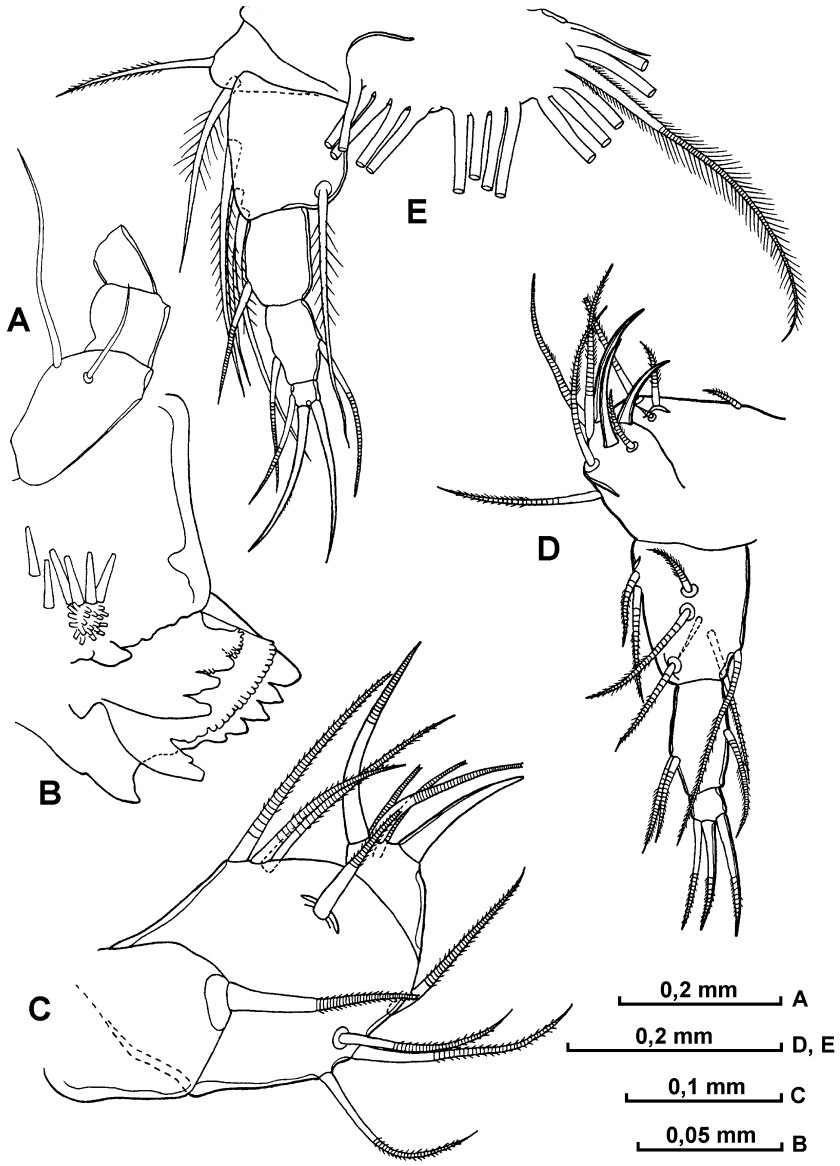


**Fig. 4.** *Halocypris angustifrontalis* n. sp. (female - N1126). A - endopodite of mandible, B - coxal endite of mandible, C - maxilla, D - 5th limb, E - 6th limb.

Mandible (Figs. 3, G-J, 4, A-B and 5, A-C, E). The 1st segment of the endopodite bears one dorsal, one lateral and one ventral setae. Last seta is 65-70% and largest seta of the 3rd segment is 80-85% of the length of the endopodite (on dorsal side), respectively.

Maxilla (Fig. 4, C). The basal seta barely reachs to the distal margin of the 1st segment of the endopodite. This segment is armed with 4 setae.

Fifth limb (Fig. 4, D). It is similar as in male.

Sixth limb (Fig. 4, E). The epipodial appendage has three groups of 5+4+6 long plumose setae and one short bare seta. Two long plumose setae are placed on the endopodite. The dorsal seta inserted on the 1st segment of the exopodite extends beyond the distal margin of the limb.

Seventh limb and caudal furca. As in male.

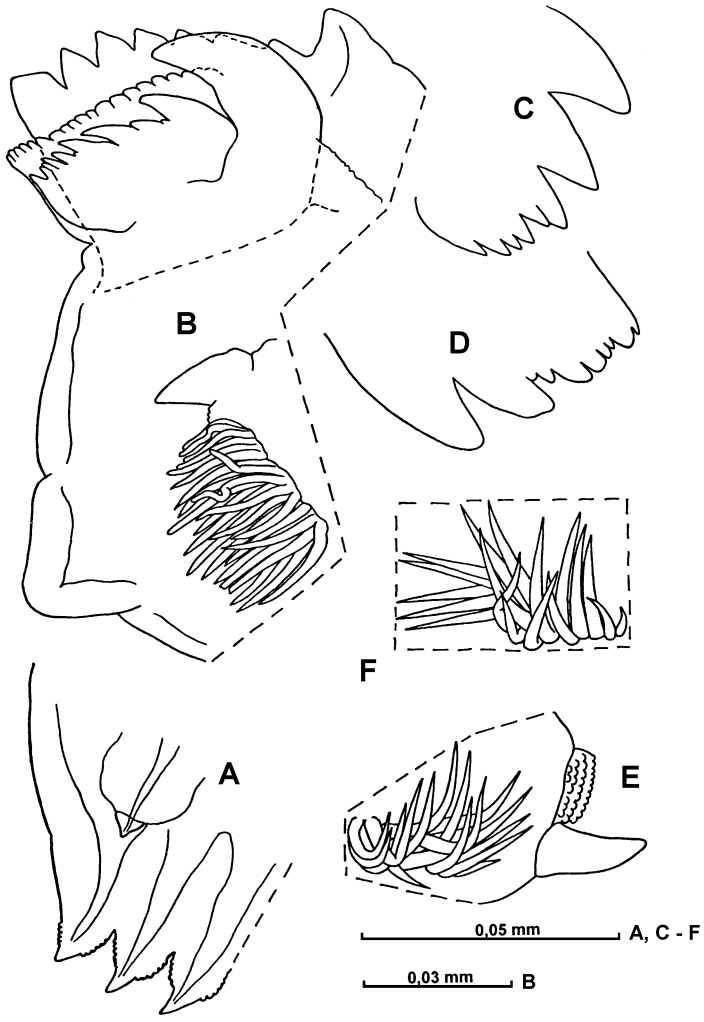


**Fig. 5.** *Halocypris angustifrontalis* n. sp. (female: A, B, C - N1142; E - N1136; male D and F - N1135). A - ventral part of basal endite on mandible, B- coxale of mandible, C and D - proximal tooth row on coxale of mandible, E and F - filaments on masticatory surface of coxale of mandible.

Comparison

This species is closely related to *H. inflata*, but differs in having a greatest size of the shell, inserting (in female) of the row from the glands at the ventromedial part of the valves, more narrow capitulum of the frontal organ, and having sensory filaments (instead of spines) on the masticatory surface of the mandible coxale.

This species differs from *H. pelagica* (in addition to the above characters) by less total number of the ventral and lateral setae placed on the 1st segment of the mandible; also less height of the copulatory appendage, and narrower its distal part.

Distribution

Our specimens of this species were caught in East Pacific between 37-40° N and 124-130° W in depth range 0-400 m, and in the West Pacific (and Pacific sector of the South Ocean) it was founded in the area 32-35° N and 141°-149° E in laeyr 0-100 m.

Poulsen (1969a) noted finding of the large specimens of *H. brevirostris* for the East Pacific in the latitude range 33° N-42° S (? depth). Probably, his specimens belong to *H. angustifrontalis* new species.

Size

Studied specimens of males and females of the new species have length range 1.63-1.95 mm and 1.80-2.20 mm, respectively. Poulsen's (1969a) specimens of males have maximum length 1.88 mm, and length of females 1.88-2.15 mm.

### ***Halocypris pelagica* Claus, 1890**

(Figs. 6-10)

*Halocypris pelagica* Claus, 1890: 25; 1891: 78, Pl. 21, Figs. 1-11; Brady and Norman, 1896: 703-704; Brady,1897: 97; Cleve, 1905: 131; Juday, 1906: 27-28, pl. 7, figs. 4-7; Vavra, 1906: 64-65; Angel,1982: 329-335, figs, 2, 3, 5-8, 10, 13,14, tables 1-3.

? *Halocypris distincta* Claus, 1890: 25.

*Halocypris brevirostris*: Skogsberg, 1920: 585 (only male in length 0.95 mm: station 116, 15° 46'S-34° 8'W); Deevey, 1968: 19-20, Figs. 2a-f, 3c-e; 1974: 358-359 (part); Angel, 1968: 305; 1969a: 540, tables 2, 3; 1969b: 78; 1979: 74-77, Figs. 67, 68 (only exceptions neuston specimens at 30° N-23° W); Poulsen, 1969a: 66 (part), Fig. 25 (for females shorter 1.4 mm from "W. Pacific"), table 8 (for female shorter 1.4 mm from: "Atlantic" - 26°-33° N, "E. Pacific" - 11°-23° S), table 9 (for male shorter 1.3 mm from: "Atlantic" - 27°-31° N, "E. Pacific" - 12°-22° S, "Atlantic-Indian" - 4° N-28° S, "Pacific" - 11° N-13° S, 33°-42° S); Ramires and Moguilevsky, 1971: 640; Chavtur, 1976: 104; 1977a: 30 (part); 1977b: 20 (part); Hanai et al., 1977: 81-82 (part); Hanai et al., 1980: 53-55 (part); Tseng, 1980: 415-416 (part: only male in length 1.1 mm) and Chen and Lin, 1995: 53.

*Halocypris inflata*: Müller, 1906a: 50-51 (part); 1912: 58-59 (part); Chen et al., 1983: 87-88, Fig. 5; Chavtur, 1992: table 2 (part).

? *Halocypris brevirostris*: Chen, 1980: 64, figs. 10-13; 1984: 89; Chen and Lin, 1991: 294; 1994a : 403, 404, 406, 408; 1994b: 414, 415, 416, 417, 419, 420, table 2; 1994c: 447, 448, 449, 450.

? *Halocypris inflata*: Chen, 1978: 41; Chen, 1982: 290, 291, 293, 296; Yin et al., 1991: 86.

Material examined

R/V "Orlyk" 1967 - male N1181 (1.25 mm), 26° 00'N, 138° 12'E, layer 0-100 m, May 19; male N1182 (1.15 mm), male N1183 (1.23 mm), male N1184 (1.15 mm), female N1185 (deformed), female N1186 (1.25 mm) 31° 30'N, 149° 00'E, layer 0-100 m, male N1187 (1.12 mm), 31° 30'N, 142° 21'E, layer 0-100 m, June 3.

Additional material: R/V SRT 662, 1953 - female (1.2 mm), station 21, 35° 14'N, 152° 07'E, layer 0-

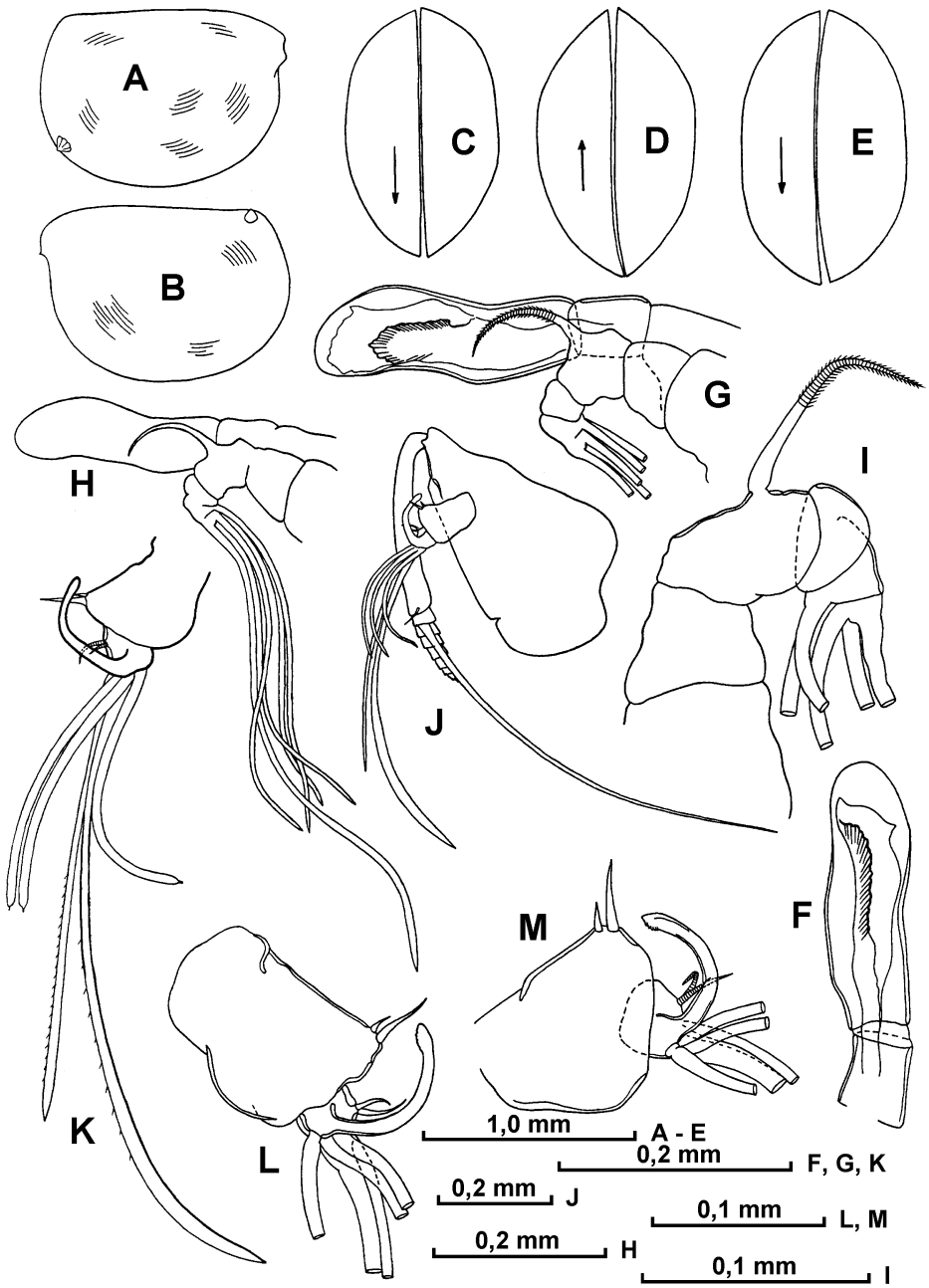


**Fig. 6.** *Halocypris pelagica* (male: A-C and F - 1182; D, J-L - N1184; E and M - N1183; G and H - N1185). A and B - right and left valves of shell in lateral view, C-E - shell in ventral view, F - frontal organ, G and H - frontal organ and 1st antenna, I - 1st antenna, J - 2nd antenna, K - right endopodite of 2nd antenna, L and M - left endopodite of 2nd antenna.

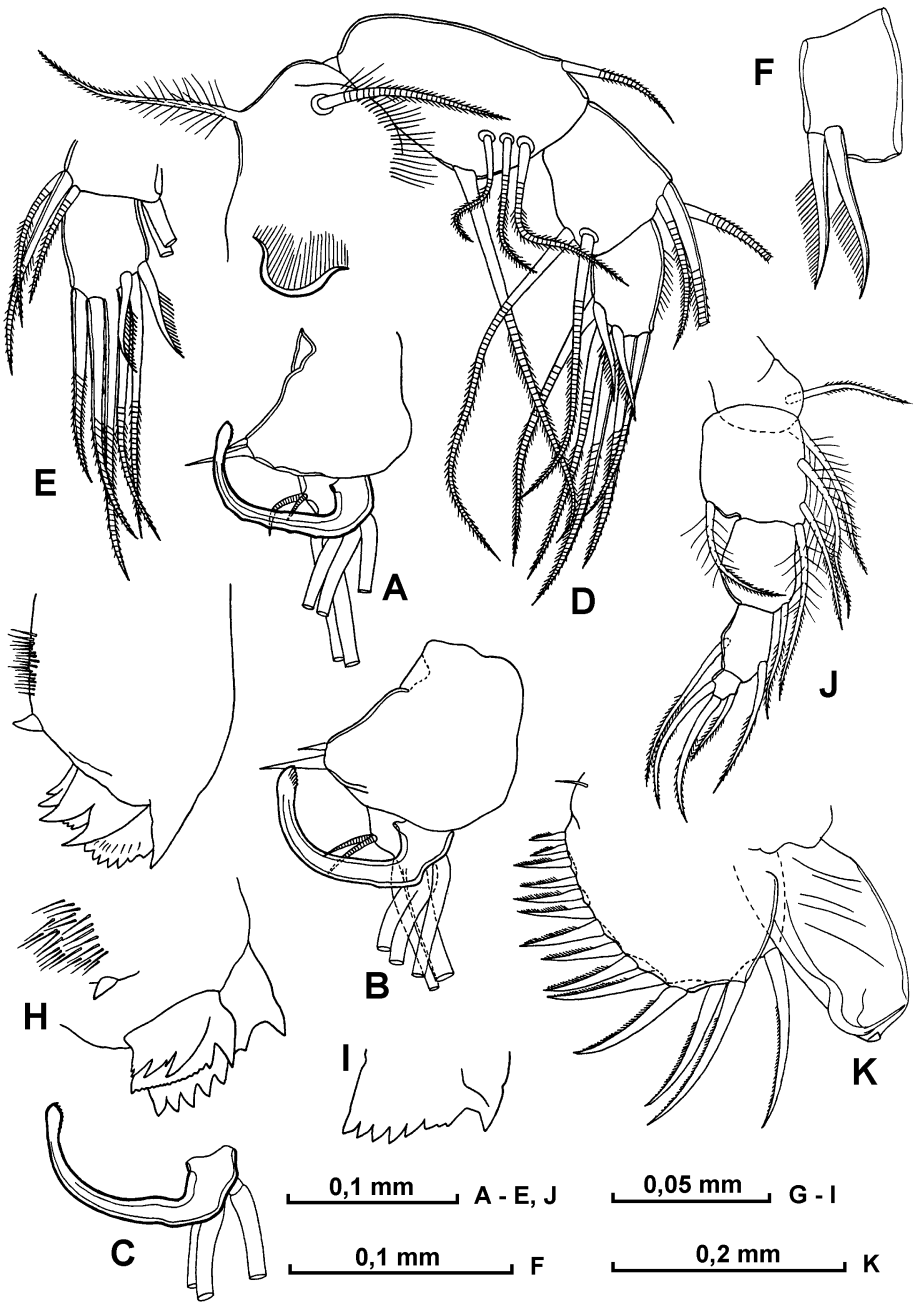


**Fig. 7.** *Halocypris pelagica* (male: A, E and J - N1182; B, D, G-I - N1183; C, F and K - N1184). A and B - right endopodite on 2nd antenna, C - right clasper of endopodite on 2nd antenna, D - mandible, E and F - distal part of mandible of endopodite, G and H - endite and masticatory pad on coxale of mandible, I - tooth edge on coxale of mandible, J - 6th limb, K - copulatory appendage and caudal furca.

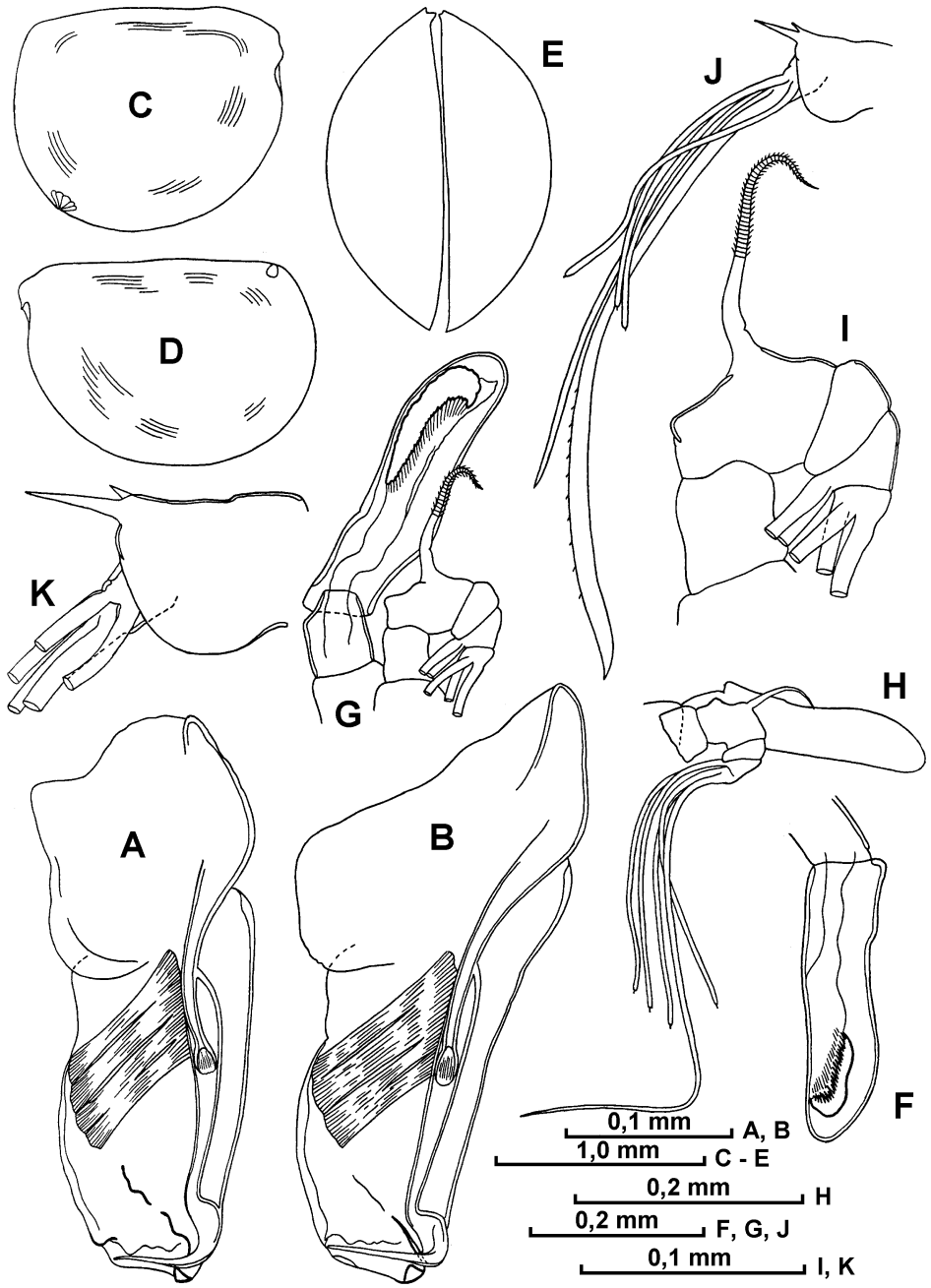


**Fig. 8.** *Halocypris pelagica* (male: A - without and B under covered glass -N1182, female: C, G, I and J - N1185; D-F, H and K - N1186). A and B - copulatory appendage, C and D - right and left valves of shell with lateral view, E - shell with ventral view, F - frontal organ, G and H - frontal organ and 1st antenna, I - 1st antenna, J and K - endopodite of 2nd antenna.

200 m, July 16; R/V "Vityaz" 20th cruise, 1955 - 2 males (1.14-1.20 mm), 2 females (1.30-1.38 mm) and 5 juveniles (0.65-0.80 mm), station 3228, 37° 18'N, 145° 16'E, layer 200-500 m, May 3; R/V "Vityaz" 29th cruise, 1958 - female (1.25 mm), station 4197, 35° 06'3N, 139° 58'5W, layer 0-200 m, December 11; R/V "Orlyk" 1967 - juvenile (0.70 mm), 37° N, 149° E, layer 0-100 m, April 30; male (1.17 mm), 4 females (1.35-1.39 mm) and 2 juveniles (0.95-0.98 mm), 35° 26'N, 143° 53'E, layer 0-100 m, May 5; juvenile (0.70 mm), 33° 40'N, 139° 12'E, layer 0-100 m, May 14; 4 males (1.20-1.25 mm), 3 females (1.32-1.35 mm) and 4 juveniles (0.72-0.80 mm), 31° 29'N, 138° 14'E, layer 0-100 m, May 16; male (1.30 mm), 31° 55'N, 138° 11'E, layer 0-100 m, May 16; juvenile (1.0 mm), 30° 30'N, 138° 12'E,

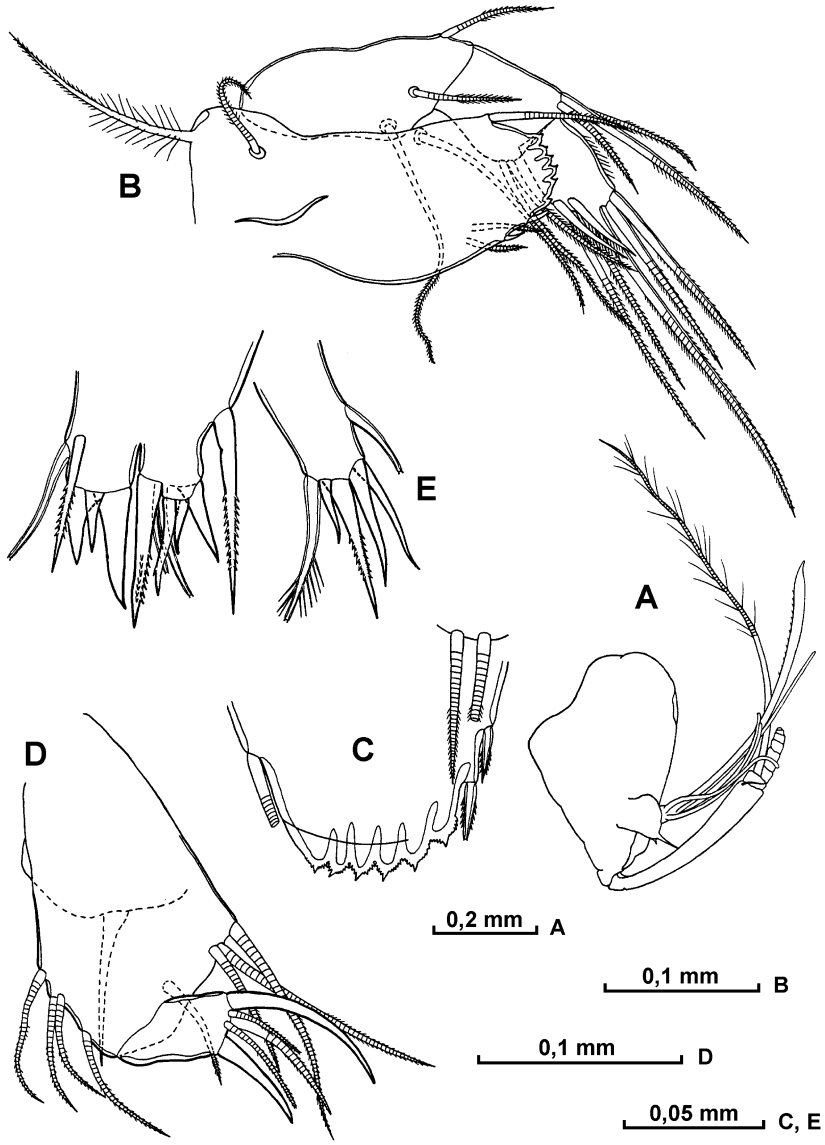


**Fig. 9.** *Halocypris pelagica* (female: A, C and E - N1185; D - N1186). A - 2nd antenna, B - mandible, C - basal endite of mandible, D - endopodite and basale of mandible, E - coxal and precoxal endites of maxilla.

layer 0-100 m, May 17; female (1.29 mm) and 2 juveniles (0.85-0.90 mm), 27° 00'N, 138° 12'E, layer 0-100 m, May 19; 2 juvenile (0.80-0.87 mm), 26° 00'N, 138° 12'E, layer 0-100 m, May 19; juvenile (0.95 mm), 21° 54'N, 138° 18'E, layer 0-100 m, May 21; female (1.43 mm) and 4 juveniles (0.70-1.00 mm), 21° N, 149° E, layer 0-100 m, May 21; 2 males (1.15-1.25 mm) and 7 juveniles (0.63-1.00 mm), 31° 30'N, 149° 00'E, layer 0-100 m, May 29; male (1.20 mm), 33° 42'N, 147° 32'E, layer 0-100 m, May 31; R/V "Orlyk" 1969 - juveniles (0.73-0.80 mm), station 10(54), sample 22, 40° N, 149° E, level 300 m, Junuary 29; R/V "Izumrud" 1969 - juvenile (1.07 mm), station 45, sample 46, approximately 42° 30'N, 135° 00'E, layer 0-100 m, June 24; R/V "Iskatel" 1969 - juvenile (0.70 mm), station 136, sample

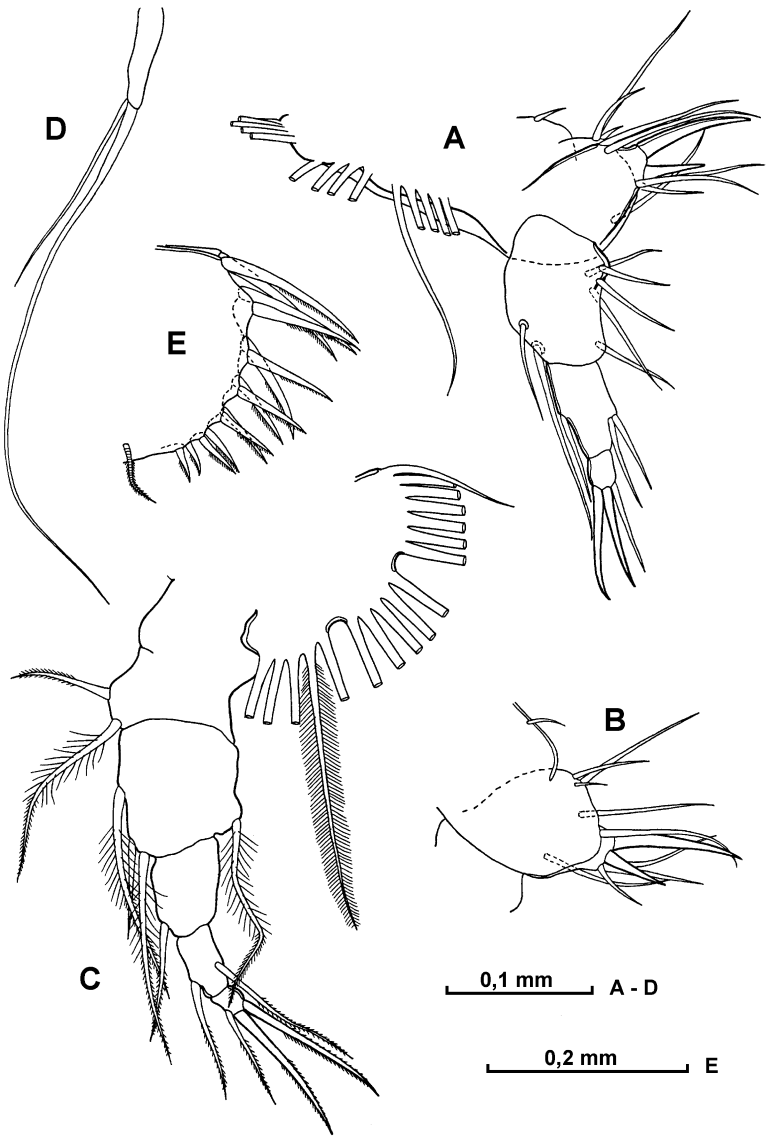


**Fig. 10.** *Halocypris pelagica* (female: A-C and E - N1186; D- N1185). A - maxilla, B - endopodite of maxilla, C - 6th limb, D - 7th limb, E - caudal furca.

90, 36°07'6N, 142°45'0E, layer 0-100 m, September 6; R/V "Ucheny" 1970 - juvenile (0.85 mm), station 94, sample 113, 35°57'N, 138°09'E, layer 0-100 m, November 18; R/V "Orlyk" 1971 - female (deformed), station?, sample 60, 37°30'N 149°00'E, layer 0-100 m, August 3; R/V "Shantar" 1977 - juvenile (0.97 mm), station 78, 33°32'N, 127°15'W, layer 0-200 m, April 19; R/V "Cavalerovo" 1980 - juvenile (0.70 mm), station 30, 39°00'N, 149°00'E, layer 0-100 m, August 23; juvenile (0.75 mm), station 47, 38°18'N, 146°35'E, layer 0-100 m, August 29; R/V "Kavalerovo", 1980 - female N1196 (1.25 mm), station 52, 35°43'N, 143°40'E, layer 0-100 m, August 30; male N1197 (1.22 mm), station 58, 34°29'N, 140°45'E, layer 0-100 m, September 1; female (1.25 mm), station 52, 35°43'N, 143°40'E, layer 0-100 m, August 30; male (1.22 mm), station 58, 34°29'N, 140°45'E, layer 0-100 m, September 1; juvenile (0.80 mm), station 66, 30°32'N, 140°39'E, layer 0-100 m, September 4; juvenile (0.82 mm), station 71, 30°58'N, 140°11'E, layer 0-100 m, September 4; juvenile (0.76 mm), station 74, 33°02'N, 139°01'E, layer 0-100 m, September 5.

Remarks

This species was described from the North Atlantic (Claus, 1890, 1891). Its first description includes only brief morphological information. Angel (1982) investigated the morphology of *H. pelagica* collected by R/V Discovery from many regions of the North Atlantic, in detail with taking into account of a literary data. As a result of comparison of our and Angel's specimens were found some differences, which are listed below (in brackets is for Angel's specimens).

Adult male. The height of the shell is 65-67% (69%) and the breadth is 63-65% (57%) of the length. The length of the capitulum of the frontal organ is 19-21% (22%) the length of the shell. The dorsal seta of the 1st antenna is covered with dense short hairs (almost bare), the dorsal margin on the 2nd segment of this limb is sharply curved (straight). The protopodite and exopodite borne on the 2nd antenna are subequal in length (protopodite is slightly longer). The seta "b" and "d" on the endopodite of this limb are subequal in length, seta "c" is shorther than "b" and longer than "a" setae (setae "c" and "d" are considerably longer than seta "b"), and seta "g" is longer than protopodite (seta "g" and protopodite are subequal in length). On the terminal segment of the mandible 2 ventrolateral short setae are pectinated (unnoticed). The seta bears on the exopodite of this limb is short and does not reache to the suture between the 1st and 2nd endopodite segments (extends beyond this suture). The posterior surface on the 1st endopodite segment of the maxilla is armed with 4 setae (6 setae), the 1st endite of this limb bears one short seta (one short and one middle in length setae), and the 2nd endite carries on long, one middle in length and one short setae (only one long seta). The endopodite of the sixth limb has 2 setae (one seta). The copulatory appendage is broader (is narrower).

Adult female. The height of the shell is 72-76% (81%) and the breadth is 73-74% (68%). The length of the capitulum of the frontal organ is 18-19% (20%) the length of the shell. Most of the characteristic features of the 1st and 2nd antennae, mandible, maxilla and 5th limb are very similar to those of the male. On the ventrolateral surface of the 1st endopodite segment of the mandible are inserted 2 setae (3 setae). The length of the unpaired bristle and 7th pair of the claws on the caudal furca are about 45 and 20% (30% both) the length of the 1st pair of the claws, respectively.

Distribution

Circumtropical - subtropical interzonal species (term "interzonal species" was introduced by Vinogradov, 1968: pp.50-52). It widely inhabits shallow and deep waters in the tropical and subtropical regions of the all oceans. In the West Atlantic (boundary between West and East Atlantic conditionally in drawn on 30°W) this species was caught in latitude range 37°N-32°S (Vavra, 1906; Skogsberg, 1920; Deevey, 1968; 1974; Poulsen, 1969a; Ramires and Moguilevsky, 1971; Angel, 1979; 1982a), and the East Atlantic it was occured between 37°N and 28°S (Claus, 1890; 1891; Brady and Norman, 1896; Müller, 1906a; Angel, 1968; 1969; Poulsen, 1969a) in the depth range 0-1500 (2000) m. Besides that, *Halocypris brevirostris* (Granata and Caporiacco, 1949; Poulsen, 1969b;

Deevey, 1978b; Gonzales and Breman, 1982) and *H. inflata* (Müller, 1906b; 1908; 1912; Alcaraz et al., 1975; Deevey, 1982b) were indicated for this ocean. Since these publications do not contain information about morphology of named species, their membership to *H. pelagica* is not able correctly to ascertain.

*H. pelagica* is known also for the Indian Ocean from the latitude range 5-28° S (Cleve, 1905; ? Müller, 1906a; Poulsen, 1969a). In addition, Müller (1908) and Leveau (1967, 1969) indicated ostracods as *H. inflata*, and Georg and Nair (1980) as *H. brevirostris* for this ocean. However, data about morphology of these species is absent in the listed works, and therefore, we can not correctly ascribe them to *H. pelagica*.

In the Pacific Ocean *H. pelagica* lives in wide latitude range. Thus, in the East Pacific this species was collected between 42° N and 42° S (Brady, 1897; Poulsen, 1969a; Chavtur, 1976; 1992; Hanai et al., 1977; 1979; Tseng, 1980; Chen et al., 1983; Chen and Lin, 1991; 1994a; 1994b; 1994c, 1995), and in the West Pacific it was occured in the area 33° N-5° S (Juday, 1906; Poulsen, 1969a) in a layered catchs from surface to 4000 m (most numerous in the depth 0-200 (500) m). Also, there are some records of *H. inflata* (Müller, 1906b; Hanai, 1959; Chen, 1982; Deevey, 1983) and *H. brevirostris* (Tseng, 1970a; 1970b; Haury, 1976) in the Pacific Ocean. However, these papers are without its morphological data, and thus taxonomical status of noted species is unelucidated.

Our original material was found in the West Pacific in the ranges 21-42° N and 138-152° E, in layered catchs from surface to 500 m, and in the East Pacific this species was collected between 33-35° N and 127-139° W in the depth 0-200 m.

Sizes

The length of males of *H. pelagica* from the Atlantic Ocean changes from 0.95 mm (Skogsberg, 1920; Deevey, 1968) to 1.26 mm (Angel, 1982a), and females from 1.00 mm (Angel, 1979; 1982a) to 1.40 mm (Claus, 1890; 1891; Angel, 1979; 1982a). Sizes of this species for the Indian Ocean are unknown. Males from the Pacific Ocean have length range from 1.05 mm (Chen et al., 1983) to 1.42 mm (Chen and Lin, 1995) and females - from 1.16 to 1.40 mm (Chen et al., 1983).

Our specimens of males and females of *H. pelagica* from Pacific Ocean - 1.12-1.30 mm and 1.20-1.43 mm, respectively.

### ***Halocypris inflata* (Dana, 1849)**

*Conchoecia brevirostris* + *C. inflata* Dana, 1849: 52.

*Halocypris inflata* + *H. brevirostris* Dana, 1853: 1301, 1303, Pl. 41, Fig. 8, 9, Pl. 91, Fig. 9a-c.

*Halocypris concha* Claus, 1874a: 177; 1874b: 7, Pl. 2, Figs. 20-25, Pl. 3, Figs. 26-35; 1890: 24-25; 1891: 77, Pl. 8, Fig. 12, Pl. 11, Figs. 6, 7, Pl. 22, Figs. 1-12, Pl. 24, Figs. 6-20, Pl. 26, Fig. 1; Brady and Norman, 1896: 702-703, Pl. 62, figs. 14-19; Scott, 1905: 370; Vavra, 1906: 63-64.

*Halocypris brevirostris*: Brady, 1880: 166, Pl. 39, figs. 1-11; Skogsberg, 1920: 584-601, figs. 112-115; 1931: 9; Poulsen, 1969a: 65 (part) (stations 3908, 4781 and 4788, males in length range 1.4-1.5 mm and females 1.5-1.8 mm), 66 (part), 25 Fig. (for "Atlantic", "Indian" and part "W. Pacific"), table 8 (for females in 1.5-2.02 mm from: "Atlantic" - 11° N-11° S, 27°-29° N), table 9 (for males in 1.4-1.5 mm from: "Atlantic-Indian" - 4° N-28° S, "Pacific" - 26°-33° N, 33°-42° S, "E. Pacific" - 12°-22° S); Moguilevsky and Angel, 1975: 296-297 (part ?); Deevey, 1970: 804; 1974: 358-359 (part), 1978a: 50; Chavtur, 1977a: 30 (part); 1977b: 20 (part); Hanai et al., 1977: 81-82 (part); Angel, 1979: 75, 76 (only specimens taken in a neuston at 30(N-23( W); Hanai et al., 1980: 53-55 (part); Tseng, 1980: 405, 415, 416, Fig. 8.

*Halocypris dubia* var. *major* Müller, 1890: 269, Taf. 28, Fig. 19, 23, 24, 30, 35

? *Halocypris concha*: Brady, 1897: 97.

*Halocypris inflata*: Müller, 1906a: 50-51 (part), Taf. 7, Fig. 19-28; 1912: 58-59 (part); Deevey, 1982a:133; Martens, 1979: 311-314, Abb. 5, 6; 1981: 68, 69, 77, 78, tables 1, 2; Angel, 1982: figs. 3,

4, 9, 11, 14, tables 1-3.

*Halocypris pelagica* + *H. globosa*: Scott, 1912: 587, Pl. 13, Figs. 29-32.

? *Halocypris inflata* + *H. toynbeeana*: Lubbock, 1860: 188, 189, pl. 29, figs. 35-39.

? *Halocypris inflata*: Müller, 1906b: 3, 1908: 65; Iles, 1953: 270;

Material examined

R/V "Vityaz" 20th cruise, 1955 - female (1.60 mm) and 2 juveniles (1.00-1.15 mm), station 3226, 37° 39'N, 144° 30'E, layer 150-1000 m, May 2; female (1.50 mm) and juvenile (1.10 mm), same station, layer 200-500 m; R/V "Orlyk" 1967 - female (deformed) and 2 juveniles (1.08-1.18 mm), 31° 55'N, 138° 11'E, layer 0-100 m, May 16; R/V "Vityaz" 45th cruise, 1969 - juvenile (1.30 mm), station 6151, sample, 285, 37° 38'6N, 143° 51'5E, layer 2000-2500 m, June 29; R/V "Orlyk" 1972 - female (1.65 mm), 1972 (1.65 mm), station 34, sample 68, 30° 00'N, 145° 00'E, layer 0-25 m, August 20; R/V "Pelamida" 1974 - male N2023 (1.53 mm) and female N2024 (1.76 mm), station 58, sample 30, 38° 00'N, 149° 00'E, layer 50-100 m, May 29; R/V "Seskar" 1975 - 3 female (1.60-1.65 mm), station 33, sample 84, 33° 29'5N, 141° 28'0E, layer 0-100 m, July 29; female (1.63 mm), R/V "Seskar" 1975 - female N2025 (1.48 mm), station 96, sample 121, 30° 00'N, 138° 00'E, layer 0-100 m, August 28; station 102, sample 115, 23° 58'N, 138° 15'E, layer 0-100 m, August 15; R/V "Pelamida" 29th cruise, 1976 - female (1.62 mm), station 114, sample 156, 23° 00'N, 138° 14'E, layer 800-1000 m, June 6: R/V "Pelamida" 30 cruise, 1976 - male N2026 (1.42 mm), station 100(91), sample 143, 26° 00'N, 138° 00'E, layer 0-100, September 1.

Remarks

For the first time this species was described and figured (Dana, 1849; 1853) from samples collected in south-western Atlantic (23° 00 S and 41° 10 W). The detailed description of its morphology has been given by Skogsberg (1920) based on the materials from this region (15-19° S and 34-37° W) and from the North Atlantic (1-30° N and 20-29° W). Most of the characteristic features of the shell and limbs in our specimens collected from the north-western Pacific are very similar to those in the Skogsberg's description. There are following differences between Pacific and Atlantic specimens only in females (in brackets from Skogsberg's description): a peg-like process of the end segment of the endopodite on the 2nd antenna is not fixed between the "h" and "i" setae (with a peg-like process), the dorsal setae on the 1st and 2nd segments of the exopodite of the 5th limb extended barely (considerably) the terminal margin of this limb, the distodorsal and distoventral setae placed on the 1st segment of the 6th limb extended barely (considerably) the terminal margin of this limb. Besides that, in both sexes the anterior surface of the endopodite of the maxilla bears only 4 setae, whereas there are 6 setae in the Skogsberg's description.

Distribution

Circumtropical - subtropical interzonal species (term "interzonal species" was introduced by Vinogradov, 1968: pp. 50-52). It widely inhabits shallow and deep water in the tropical and subtropical regions of the all oceans. In the Atlantic Ocean this species was occurred in the latitude range 60° N-42° S from surface to 1000 m and rarely deeper (Dana, 1849; 1853; ? Lubbock, 1860; Claus, 1874a; 1874b; 1890; 1891; Brady, 1880; ? 1897; Brady and Norman, 1896; Vavra, 1906; Scott, 1912; Müller, 1906a; 1912; Skogsberg, 1920; 1931; ? Illes, 1953; Moguilevsky and Angel, 1975; Angel, 1979; 1982; Poulsen, 1969a; Deevey, 1970; 1974). Besides that, in the row publications were indicated *H. inflata* (Müller, 1906b; 1908; Alcaraz et al., 1975; Deevey, 1982b) and *H. brevirostris* (Granata and Caporiacco, 1949; Poulsen, 1969b; Deevey 1978b; Gonzales and Breman, 1982) for this ocean. Since, these publications do not contain information about morphology of the named species, that their membership to *H. inflata* is not able correctly to ascertain.

*H. inflata* is known also for the Indian Ocean from the Island Shri-Lanka to 36° S (Brady, 1880; Scott, 1905; M(ller, 1906a; 1912; Poulsen, 1969a) in shallow waters and also in a vertical tows from

2000-3000 m to surface. In addition Müller (1908) and Leveau (1967, 1969) indicated ostracods as *H. inflata*, and Georg and Nair (1980) as *H. brevirostris* for this ocean. However, data on morphology of these species is absent in listed works, and therefore, we can not correctly ascribe to *H. inflata*.

In the Pacific Ocean *H. inflata* lives in wide latitude range. Thus, in the East Pacific this species was found between 35° N and 42° S (Brady, 1880; Müller, 1890; Brady and Norman, 1896; Poulsen, 1969a; Chavtur, 1977a; 1977b; 1992; Hanai et al., 1977; 1980; Tseng, 1980), and in the West Pacific it was collected in the area 33° N-42° S (Claus, 1874a; 1874b; Poulsen, 1969a; Deevey, 1978; Martens, 1979; 1981) in the depth range 0-2000 m, but most numerous in layer 0-200(500) m. Also, there are some records of *H. inflata* (Müller, 1906b; Hanai, 1959; Chen, 1982; Deevey, 1983) and *H. brevirostris* (Tseng, 1970a; 1970b; Haury, 1976) in the Pacific Ocean. However, these papers are without its morphological data, and thus taxonomical status of noted species is unelucidated.

In the South Ocean *H. inflata* was caught only near its northern boundaries, where warm water-masses are located; in the its Indian sector to 54° S on the south in the depth range 0-2500 m (Deevey, 1982a), and in the Pacific sector it occurs to 49° S in the depth 0-2000 m (Brady, 1880; Deevey, 1978a). Besides that, Deevey (1983) noted *H. inflata* in the ostracod list for the region 35-47° S in layer 0-1000 m. However, additional information about its morphology is need for confirmation of membership to discussed species.

Our original material was collected in the Pacific Ocean in the area 23°-39° N and 136°-149° E in a layered catchs from surface to 2500 m (most numerous in layer 0-200 m), and in region 13° N-92° W in layer 200-500 m.

Size

The length of males of *H. inflata* from the Atlantic Ocean changes from 1.32 mm (Angel, 1982) to 1.60 mm (Dana, 1853; Skogsberg, 1920; Angel, 1982, 1993) and females are from 1.48 mm (Angel, 1982) to 2.02 mm (Poulsen, 1969a). In the Indian Ocean (and Indian sector of the South Ocean) males have length range 1.40-1.54 mm (Deevey, 1982a) and females are 1.40-1.70 mm (Deevey, 1982a), and in the Pacific Ocean (and Pacific sector of the South Ocean) the length for males are 1.36-1.57 mm (Martens, 1979) and for females are from 1.51 mm (Martens, 1979) to 1.80 mm (Tseng, 1980).

Our specimens of males and females of H. inflata from the Pacific Ocean the length of males and females are 1.42-1.53 mm and 1.48-1.76 mm, respectively.

## Genus *Felia* Poulsen, 1969

This genus contains *F. cornuta* (Müller, 1906), *F. bicornis* (Müller, 1906) and *F. dispar* (Müller, 1906). Only *F. cornuta* and *F. bicornis* were caught by Russian expeditions in the North Pacific.

Key to Species of Genus *Felia* (from Poulsen, 1969a)

Shell valves anteroventrally with a round verruca; shoulder-vault very strongly developed with a round dorsally projecting process anteriorly of the basis of the spine
..... *Felia bicornis* (Müller, 1906)

Shell valves without verruca; shoulder-vault only evenly arched dorsally
..... *Felia cornuta* (Müller, 1906)

### *Felia cornuta* (Müller, 1906)

(Figs. 11 and 12)

*Halocypris cornuta* var. *typica* Müller, 1906a: 18, Taf. 5, Fig. 8, 9, Taf. 8, Fig. 1-3, 5-7; 1906b: 3; 1908: 65.

*Halocypris cornuta cornuta* Müler, 1912: 58.

*Felia cornuta*: Poulsen, 1969a: 78-89, figs. 33-37: 1969b: 145, 146, fig. 7; 1977: 5; Deevey,

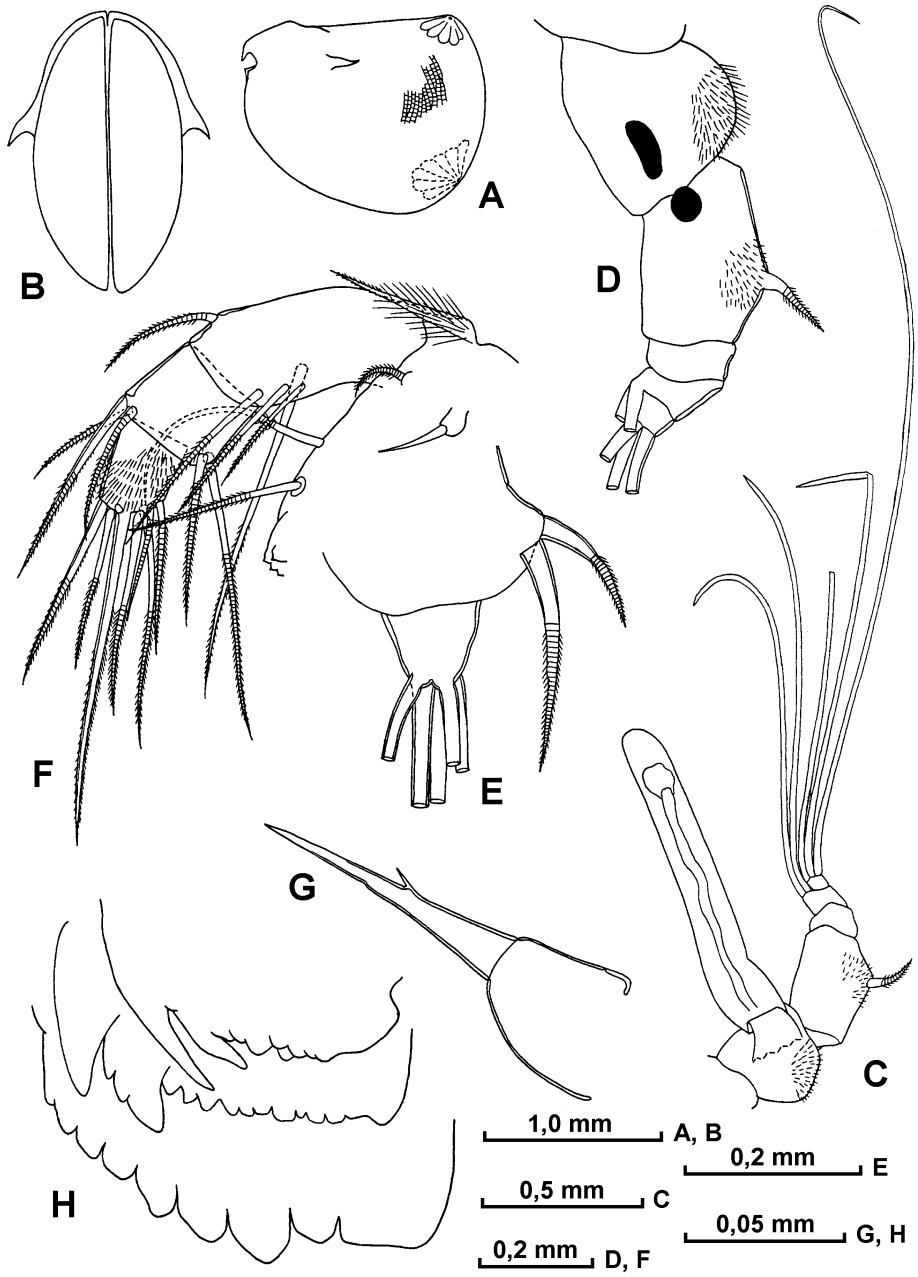


**Fig. 11.** *Felia cornuta* (female: R/V Vityaz, 1969 - St. 6151, sample 287) A - left valve of shell with lateral view, B - shell with ventral view, C - frontal organ and 1st antenna, D - 1st antenna, E - endopodite of 2nd antenna, F - mandible, G - epipodite of mandible, H - tooth edge, distal and proximal tooth rows on coxale of mandible.

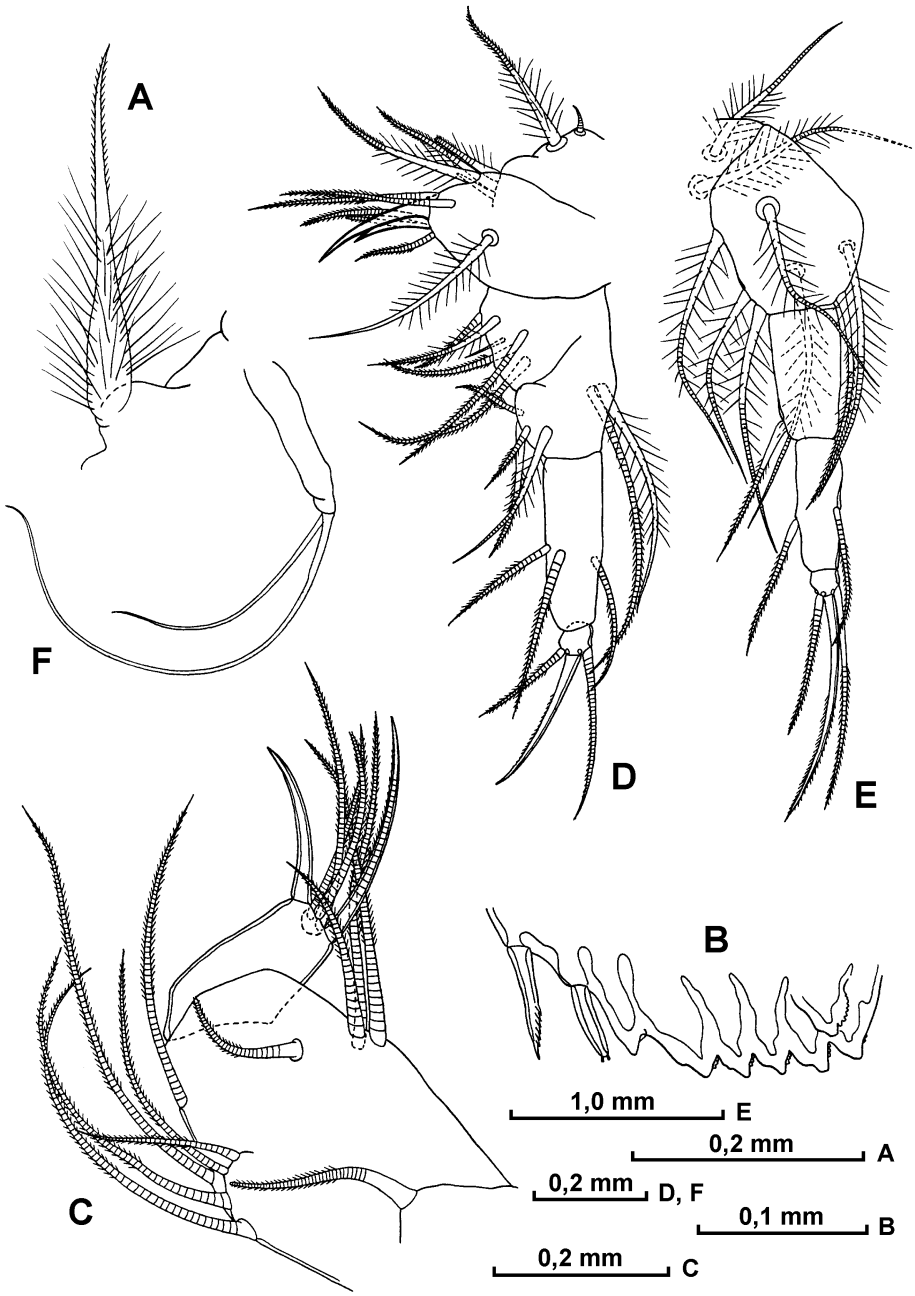


**Fig. 12.** *Felia cornuta* (female: R/V Vityaz, 1969 - St. 6151, sample 287) A - endopodite of mandible, B - basal endite of mandible, C - maxilla, D - 5th limb, E - 6th limb, F - 7th limb.

1982a: 133, 134, 135, 136; Hanai et al., 1977: 82; Hanai et el., 1980: 56-57; Chen et al., 1983: 90, fig. 8; Yin et al., 1991: 87.

*Felia cornuta cornuta*: Chavtur, 1977a: 30; Deevey, 1978a: 45, 50; 1978b: 54, 67, 68; Chen, Lin, 1995: 54, fig. 61 (1, 2).

Material examined

R/V "Vityaz" 20th cruise, 1955 - juvenile (length 1.60 mm), station 3238, 36°11'N, 155°10'E, layer 200-500 m, May 9; immature female (2.50 mm) and immature male (2.40 mm), station 3241, 38°17'N, 157°39'E, layer 234-562 m, May 10; R/V "Vityaz" 45th cruise, 1969 - female and male (deformed), station 6151, sample 287, 37°38'6N, 143°51'5E, layer 750-1000 m, June 29; male (3.50-3.60 mm are lost) and female (4.05 mm), same station, sample 283, layer 1000-1500 m; R/V "Pelamida" 1974 - 2 immature females (2.60 mm, other specimen is deformed), station 58, 38°00'N, 149°00'E, layer 800-1000 m, May 29; 3 immature females (2.45-2.6 mm), same station, layer 600-800 m; immature female (2.50 mm), station 69, 33°30'N, 149°00'E, layer 800-1000 m, June 1.

Remarks

Müller (1906a) gave a brief description for *F. cornuta* for the first time. Same literature include information only on the shell, frontal organ and 1st and 2nd antennae (Chen et al., 1983; Chen and Lin, 1995). Only Poulsen (1969a) described and illustrated this species in detail.

Our specimens of the females (males are deformed or lost) somewhat differ from previous descriptions in following respects: the height of the shell is about 80% of the length (approximately 85% in Müller, 1906, about 75% in Chen et al., 1983, 77% in Chen and Lin, 1995, and 66-82% in Poulsen, 1969a), and its anterodorsal horns are smaller than those noted in Müller's description (Taf. 8, Fig. 3). The frontal organ is broader (narrower in Müller, 1906: Taf. 8, Fig. 6; Poulsen, 1969a: Fig. 33a; Chen and Lin, 1995: Fig. 61.2). The dorsal side on the 1st segment of the 1st antenna is strongly convex (straight in Müller, 1906: Taf. 8, Fig. 7; Poulsen, 1969a: Fig. 33b, c), the dorsal seta placed on the 2nd segment is approximately 60% the height of it (90-100% in Müller, 1906 and 75% in Poulsen, 1969a, figures are such), the 2nd segment is undivided by suture (diveded in Poulsen, 1969a: 82, Fig. 33b), only dorsal surface on the 1st and 2nd segments of this limb are covered with hairs (dorsal and ventral surface in Poulsen, 1969a: Fig. 33a-c). Dorsal margins of the 1st and 2nd segments on the endopodite of the 2nd antenna are placed at an angle of about 45° (without angle in M(ller 1906: Taf. 8, Fig. 5; Poulsen, 1969a: Fig. 33e), there is no hairs on the 1st segment (hairs are present in Poulsen, 1969a: 82, Fig. 33e), the seta "a" of this segment is approximatelly 60% the length of the seta "b" (about 50% in Müller, 1906 and 70% in Poulsen, 1969a, figures are such, and 60-70% in Chen et al., 1983: Fig. 8e). The surface on the 1st segment of the 2nd antenna is uncovered with hairs (covered in Poulsen, 1969a and Chen et al., 1983, figures are such).

Differences are listed below only between our females and Poulen's specimens (in brackets for Poulsen, 1969a): the seta on the exopodite of the mandible is very thick at its base (usual seta); the anterodorsal seta on the basale of this limb is about 1/4 the length of the 1st segment on its endopodite (about 1/2 the length - Fig b. 33 h, i). The length of the basal seta inserted on the maxilla is short and about 85% the height of its endopodite (seta and height of endopodite are subequal - Fig. 34a); the 1st segment of the endopodite is armed with 4 long and 2 short anterior, and one lateral setae (with 4-5 subequal setae and without lateral setae - p. 82-83, Fig. 34a); on the 2nd segment of this limb anterior claw is shorter than posterior claw (both subequal - figures are such), and central claw and 2 subterminal setae on this segment are long (short - figures are such). The 2nd endite on the protopodite of the maxilla bears 2 long and one short setae (only 2 long setae - p. 83, Fig. 34e). On the 1st segment of the endopodite of the 6th limb are placed 7 setae, of which 6 plumose (6 setae,of which 4 plumose - p. 83, Fig. 34f); all these setae, except of the distodorsal seta, are longer than those in Poulsen's description. The short seta on the 7th limb is considerably longer than that of this limb (about subequal - Fig. 34g).

Distribution

Circumtropical - subtropical bathypelagic species. It inhabits deep-sea zone of the tropical and subtropical regions of three oceans. In the East Atlantic (boundary between East and West Atlantic conditionally is drawn on 30° W) Felia cornuta was occured in the area 14° N-36° S and 13° E-22° W in a vertical tows from 4000 m to 0-600 m (Müler, 1906a; 1908; Poulsen, 1969a; 1969b), and in the West Atlantic it was noted only for the region 11-12° N and 65-66° W in a vertical tows 1000(1200) - 0 m (Deevey, 1978b). In the Indian Ocean *F. cornuta* was caught between 5° N-4° S and 62° -96° E in a vertical tows 2000(2500) - 0 m and 1100(1200) - 0 m (Müller, 1906a; Poulsen, 1969a). In the East Pacific it was found from the Japan (Misaki, approximately 40° N) to 34° S and between 111-178° E in the main in a vertical tows 2000-0(75) m (Müller, 1906b; Poulsen, 1969a; Chen et al., 1983; Chen and Lin, 1995), and in the West Pacific with species was occurred in the area 7° N-13° S and 78-176° W in the depth 50(75)-500(2000) m (Poulsen, 1969a). In the South Ocean *F. cornuta* was caught in the region 40° S-15° E (Atlantic sector) in a vertical tow 1500-0 m (Müller, 1906a), and also between 41-51° S and 150° E-159° W (Pacific sector) in the depth 75-750(1000) m and 500(750)-1000(2500) m (Poulsen, 1969a; Deevey, 1978a; 1982a).

Our original material came from the region 33° -38N and 143-157° E in the depth 200-1500 m.

Sizes

Müller (1906a) described the length for males and females as 3.1-3.25 mm and 3.2-3.5 mm, respectively. Poulsen's (1969a) specimens have following length range: males 3.0-3.4 mm and females 3.0-3.7 mm. Deevey (1978a; 1978b; 1982a) noted the length for male as 2.65 mm and for females as 2.65-2.80 mm.

The length of the our specimens of males are 3.5-3.6 mm and female is 4.05 mm.

### ***Felia bicornis* (Müller, 1906)**

(Figs. 13-15)

*Halocypris bicornis* Müller, 1906a: 49-50, Taf. 8, Fig. 8-12, 17, 1908: 65; 1912: 58.

*Halocypris taurina* Vavra, 1906: 66-67, Taf. 7, Fig. 128-132a.

*Felia bicornis*: Poulsen, 1969a: 89-94, figs. 38-40; 1977: 5; Deevey, 1970: 804, fig. 2; 1978b: 67, 68; 1982b: 469, 470, 475, 476, figs. 6, 7; 1983: table 1; Chavtur, 1977a: 30; Hanai et al., 1980: 56; Chen, 1980: 65; Chen et al., 1983: 89, fig. 7; Yin et al., 1991: 88; Chen and Lin, 1995: 3, 53-54, figs. 5 (8), 60; 1994: table 2.

Material examined

R/V "Vityaz" 20th cruise, 1955 - juvenile (deformed), station 3238, 36° 11'N, 155° 10'E, layer 200-500 m, May 9; R/V "Vityaz" 29th cruise, 1958 - male (length 2.9 mm), station 4183, 40° 01'N, 127° 39'W, layer 200-500 m, December 6; R/V "Vityaz" 57th cruise, 1975 - juvenile (1.7 mm), station 7260, 5° 38'0 S, 130° 48'3 E, layer 200-300 m, March 18.

Remarks

Most descriptions of this species include data only for the shell, frontal organ, and 1st and 2nd antannae (Müller, 1906a; Vavra, 1906; Deevey, 1970; Chen et al., 1983; Chen and Lin, 1995), and only Poulsen's monography (1969a) and Deevey's paper (1982b) contain information for the other limbs.

Our male has some differences from previous descriptions as follows: the basal segment of the 1st antenna has not a longitudinal spiny ridge on the outer side (with a longitudinal spiny ridge in Deevey, 1982b: 478, Fig. 6d, f); the seta "d" on the endopodite of the 2nd antenna is about 1/2 the length of the seta "a" (setae "d" and "a" are subequal in Müller, 1906: Taf. 8, Fig. 11, 12; and 1/3 the length of the

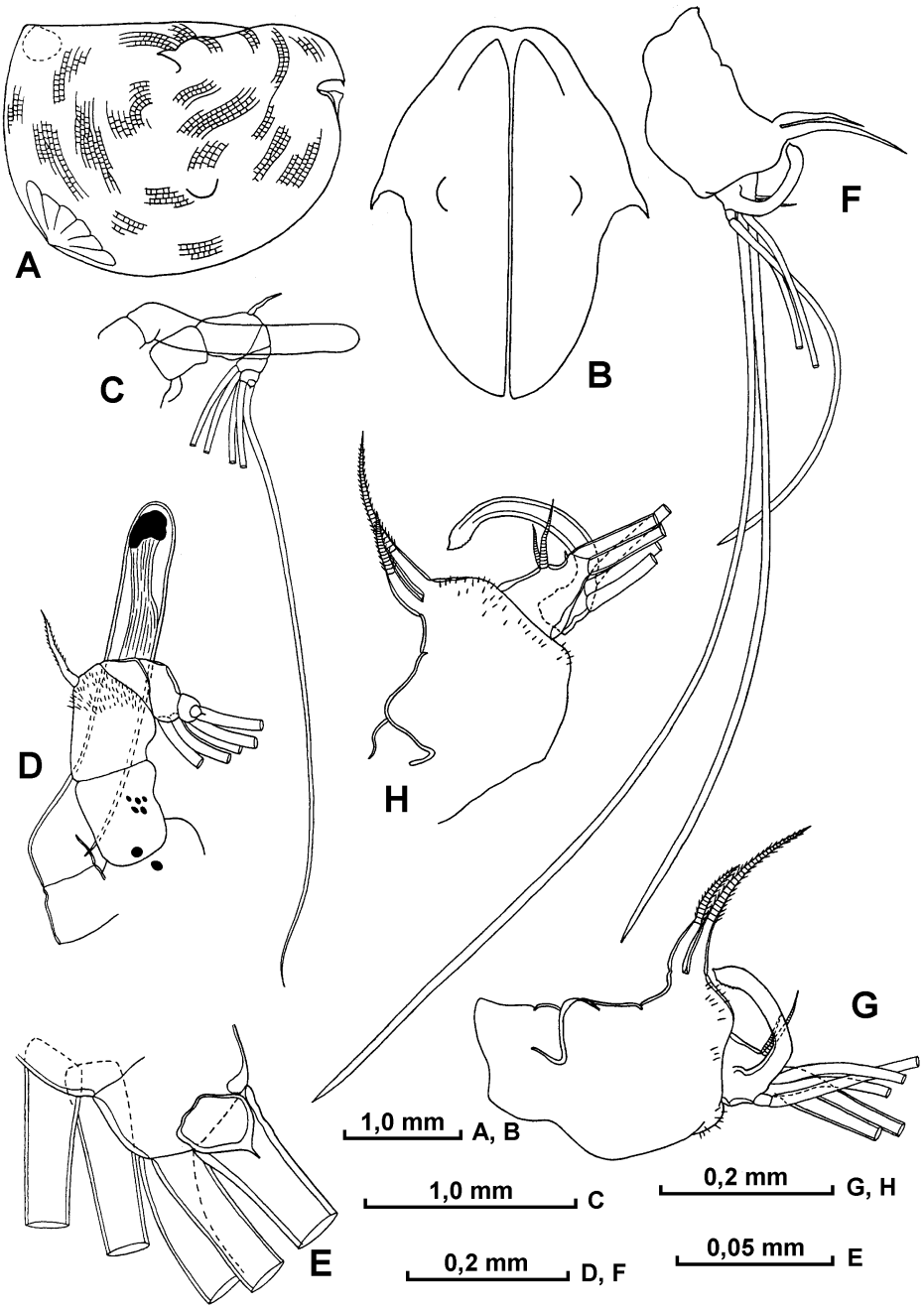


**Fig. 13.** *Halocypris bicornis* (male: R/V Vityaz, 1958 - St. 4183) A - right valve of shell with lateral view, B - shell with ventral view, C and D - frontal organ and 1st antenna, E - terminal part of 1st antenna, F and G - left endopodite of 2nd antenna, H - right endopodite of 2nd antenna.

seta "a" in Poulsen, 1969a: Fig. 38b, d); the 1st segment on the maxilla bears 6 anterior and one lateral setae (only 4 anterior setae and without lateral seta in Poulsen, 1969a: 91) and without some distal spinules (with distal spinules in Deevey, 1982b: Fig. 7c); the distoventral seta on the endopodite of the 5th limb is extended conciderably beyond the distal margin of the 1st exopodite segment (only reachs the distal margin in Deevey, 1982b: Fig. 7e); the 1st exopodit segment of the 6th limb is armed with 7 setae (6 setae in Poulsen, 1969: 91) the setae placed on its 2nd segment is extended to the terminal margin of this limb (is not extended in Deevey, 1982b: 7f).

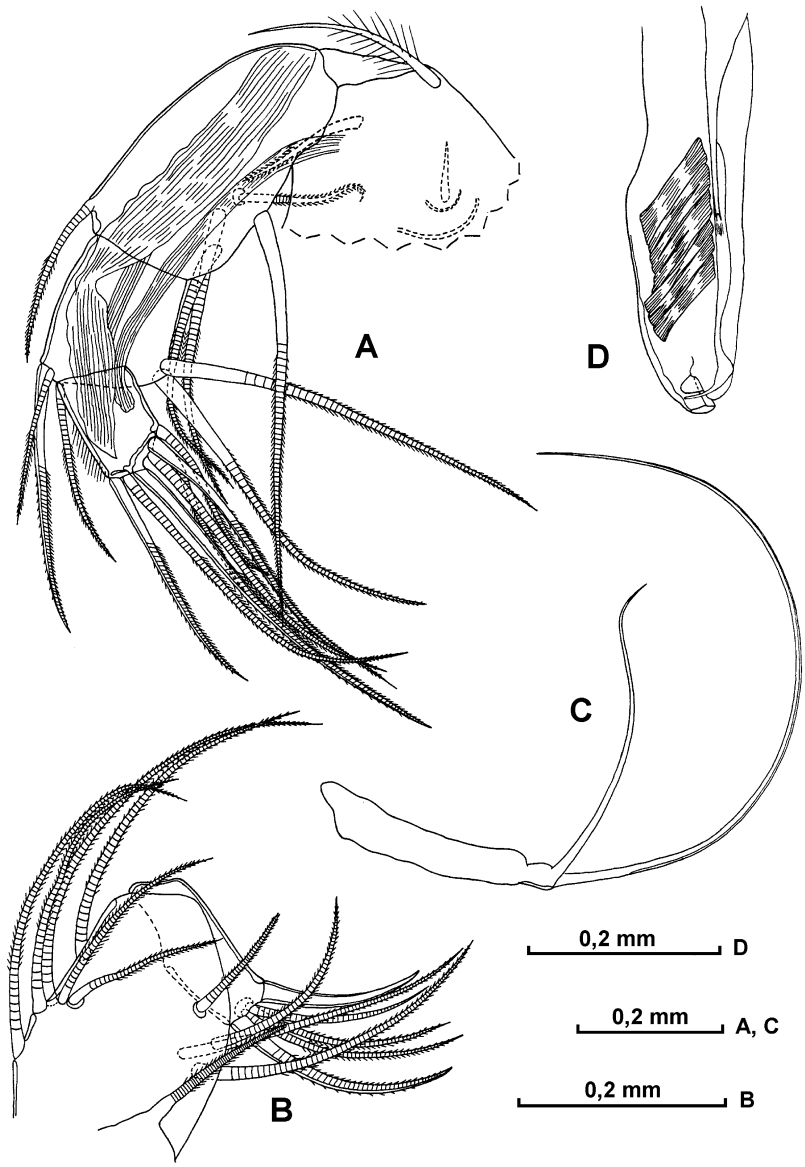


**Fig. 14.** *Felia bicornis* (male: R/V Vityaz, 1958 - St. 4183) A - mandible, B - maxilla, C - 7th limb, D - copulatory appendage.

Distribution

Circumtropical - subtropical bathypelagic species. It lives in the deep-sea zone of the tropical and subtropical regions of three oceans. In the East Atlantic (boundary between East and West Atlantic conditionally in drawn on 30° W) *F. bicornis* was found in the area 2° N-19° S and 3° E-20° W, and also in the region 46° N-8° W, mainly in a vertical tows from 3000 m to surface (Müller, 1906a; 1908; Vavra, 1906; Poulsen, 1969a). In the West Atlantic it occured between 15° N-3° S and 32° -61W in a vertical tows 1200-0 m and in a layered catchs from 75-150 m to 500-3000 m (Vavra, 1906; Poulsen,

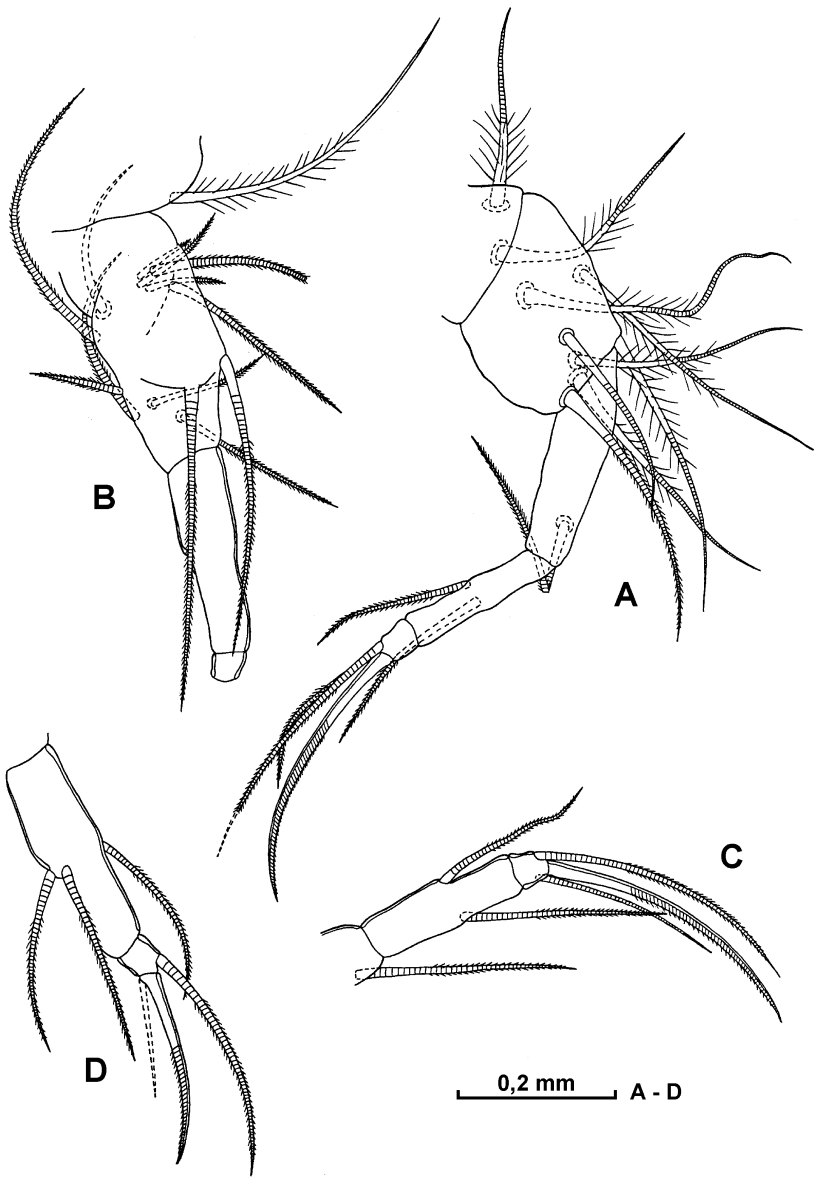


**Fig. 15.** *Felia bicornis* (male: R/V Vityaz, 1958 - St. 4183) A - 6th limb, B - 5th limb, C - distal part of 6th limb, D - distal part of 5th limb.

1969a; Deevey, 1970; 1978b; 1982b). For the Indian Ocean *F. bicornis* is known from 7°-12° S and 48-98° W in a layered catchs from 2000-2500 m to surface (Müller, 1906a; Poulsen, 1969a). In the East Pacific it was registered for the area 4°-28° S and 116-177° W in the depth (50(75)-400(1500) m (Poulsen, 1969a), and in the West Pacific this species was caught between 24° N-7° S and 119°-138° E in the depth range from 75-100 m to 1750 m (Poulsen, 1969a; Chen et al., 1983; Chen and Lin, 1995). In the South Ocean *H. bicornis* was found in the region 43° S-36° E (Indian sector) in a vertical tow 2500-0 m (M(ller, 1908), and also in 41° S-176° E (Poulsen, 1969a) and in 39° S (longitude is unknown) (Deevey, 1983) in layers 75-1250 m and 250-500 m, respectively (Pacific sector).

Our original material came from the regions 36° N-155° E, 40° N-127° W and 5° S and 130° E in the depth 200-300(500) m.

Sizes

Müller (1906a) recorded for male and female as equal length 1.83 mm. Vavra's (1906) specimen of female has length 2.2 mm. In the Poulsen's monography (1969a) mean length was noted for males and females as 1.61 and 1.81 mm, respectively. The length range of Deevey's (1970; 1978b; 1982b) males is 1.7-1.9 mm and females 1.9-2.0 mm. Chen et al. (1983) and Chen and Lin (1995) gave the length of males as 1.44-1.59 mm and females as 1.74-1.85 mm. The length of our specimen of male is 2.9 mm.

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